

International Academy Journal of Business Administration Annals Volume 9, Issue 5, PP 91-106, ISSN: 2382-9175, December, 2023 DOI: 2721-4282-371-956 Double Blind Peer Reviewed International Research Journal arcnjournals@gmail.com https://arcnjournals.org ©Academic Science Achieves (ASA)

Artificial Intelligence Implementation and Organizational Performance of Mainstream Oil and Gas Companies in Nigeria

Ikegwuru, Mac-Kingsley (PhD)

Department of Marketing, Rivers State University, Port Harcourt, Nigeria Jack, ObiaziTubotamun-Ojas (PhD) Department of Accountancy, Rivers State University, Port Harcourt, Nigeria Amadi, Ngozi Eleba(PhD)

Department of Accountancy, Rivers State University, Port Harcourt, Nigeria

Abstract: This paper seeks to critically evaluate the nexus between artificial intelligence and organizational performance by means of empirical analysis. The population of this study was drawn from the eleven (11) mainstream oil and gas companies which are quoted on the Nigerian Stock Exchange and the population is also assumed as the sample size, since it is less than 30. The simple random sampling technique was adopted to draw one hundred and seventy-six (176) respondents for the study, on a sample frame of sixteen (16) respondents per firm. A structured questionnaire anchored on a five point likert scale ranging from strongly disagreed to strongly agree was adopted to test the cause-effect relation between two or more variables than other statistical methods like non-parametric tests. In this study, descriptive analysis (mean and standard deviation) were presented with a view to emphasizing the reliability and validity of estimates obtained. A confirmatory factor analysis was performed and the outcome reveals that, that artificial intelligence implementation significantly associates with organizational performance. The study therefore, concludes that, artificial intelligence implementation significantly associates in Nigeria, and recommends that, management of mainstream oil and gas companies should implement AI capabilities to generate higher efficiencies in processes, decision making, costs and fuel modernism to attain optimal organizational performance.

Keywords: Artificial intelligence implementation, Dynamic capability theory, Mainstream oil and gas companies Organizational performance, Resource based view theory.

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INTRODUCTION

In the contemporary business world, Artificial Intelligence (AI) implementation in day after day business has grown to be a powerful drift in different business functions crosswisea variety of industries. Developing the capacity to digitally revolutionalize or transform business processes through AI is becoming progressively more important for businesses, as a continuouslyrising number of their activities are currently turning out to be AI powered. This signals an appreciation of how businesses should systematize so as to obtain value from AI. The questions of what impacts against organizational performance can be expected with AI application, and how to make the most of AI application to realize modernism in business enterprise successful accomplishments have become exceptionally fascinating for business organizations

Business nowadays in hi-tech epoch is perceptibly influenced by Artificial Intelligence (Agarwall, Das & Swain, 2021)). Artificial Intelligence needs to be considered as a significant building block in the growth of business, since it is the digital technology that must be transported simultaneously to make easy enhanced organizational performance. The application of AI technology can enable firms boost their business value and capability. This is achievable when businesses take up the technologies to re-construct their processes (Agarwall, Das & Swain, 2021). Organizations need to take advantage of AI's capacity to remain feasible. With the swift spreading out of artificial intelligence (AI) paraphernalia, organizations from up-and-coming markets have commenced implementation of AI utilities to enhance their performances and unearth features to reproduce their business.

Process automation in organizations entails the appliance of information technology to a good number activity of the organization. Hence, the application of AI to business processes may enhance organizational performance and generate competitive advantage. Studies have shown that information technology has premeditated upshots and can add to the accomplishment of organizational objectives (McRobert *et al.,* 2018).

Humans reside in a world where technological advancement is moving ahead with a rapid rate, and with a large quantity of information and data being produced and stockpiled. It is predictable that the global data volume attained 59 zettabytes in 2020 and is projected to 149 zettabytes in 2024 (Host, 2021), given that 1 zettabyte equals to spectacularly 1021 bytes. It is then obvious that the world has come into an age of big data where artificial intelligence pooled with big data opens up several possibilities that would be restricted for the human brain to process.

Several related studies had analyzed the impact of artificial intelligence on organizational performance for example, Mikalef *et al.* (2023) examined AI capabilities and organizational performance, Mikalef *et al.* (2023) developed a conceptual research model that explores the influence of AI competencies on B2B marketing capabilities and organizational performance, Agarwall, Das and Swain (2021) investigated the influence of AI on operating performance, Iwuanyanwu (2021) investigated the institutional factors affecting the application of Artificial Intelligence, AI-Walai and Liang (2021) examined the impact of artificial intelligence on management and leadership, and Zehong and Zheng (2018) considered the impact of artificial Intelligence on accounting fraud and accounting information quality

Existing studies on the connection between artificial intelligence implementation and organizational performance in the Nigerian context is somewhat scarce even though there is a strong significance for artificial intelligence to be brought into organizational performance for realizing flourishing modernism. This study endeavors to fill this gap in literature and investigates the nexus between artificial intelligence implementation and organizational performance of mainstream oil and gas sector of Nigeria.

LITERATURE REVIEW

Theoretical Foundation

Today, artificial intelligence has experienced unparalleled innovations, thus giving rise to additional scientific studies aiming to analyze their influence on organizational performance through several theoretical models and foundations: This present study is therefore, anchored on the Resource-Based View Theory (RVT) and Dynamic Capabilities Theory (DCT).

Resource-Based View theory

It is as clear as crystal that, businesses contains resources (human resources, business resources and technological resources) which are priceless, exceptional, difficult to duplicate, faultily substitutable and non-transportable, a compartment of which allows organizations to launch a competitive point, competitive and fortunate advantage, a spring of better-quality performance, given that they are sheltered against replication and replacement (Peteraf & Barney, 2003; Powe & Dent-Miccallef 1997 Barney, 1991; Grant, 1991;Wemerfelt, 1984).

Artificial intelligence is information technology, and information technology competence itself entails the aptitude to muster IT-based resources in mishmash with other resources and capabilities (Bharadwaj, 2000). Information competence is fabricated on substantial resources, human resources and insubstantial resources (Nason & Wiklund, 2018; Pitelis, 2007; Priem & Butler, 2001). This theory is relevant to this study because, artificial intelligence being an information technology that allows organizations to initiate a competitive position, gives the impression that AI is positively linked with organizational performance.

Dynamic Capabilities

Dynamic capability is the latent of an organization to reconfigure, incorporate and synchronize internal and external skills to handle swift instability in business settings (Teece *et al.*, 1997; Ericksson, 2014). To generate, improve or renovate organizational capabilities, the organization utilizes specific processes that employ and articulate dynamic capabilities. Individual skills establish, direct and sustain the dynamic capabilities of the organization (Kim, 2011), which can be distinguished as a connection between organizational resources and performance. Businesses can in actual fact use competitive arrangement of resources to enhance performance at the organizational and process level (Wamba, 2017; Kohlbacher, 2013; Benner, 2009; Dosi, Nelson & Winter, 2007). This theory is applicable to this study because, the implementation of artificial intelligence can refurbish organizations explicit processes, launch, direct and sustain the dynamic potentials of the given organization for enhanced organizational performance.

The Concept of Artificial Intelligence

The term "artificial intelligence" was originally invented by John McCarthy in 1956 in an academic conference (Anyoha, 2017). Artificial intelligence (AI) was pioneered to build up and create "thinking machines" that are talented inimitating, learning, and substituting human intelligence. Artificial intelligence (AI) is occasionally called machine intelligence, and it is accepted that AI is one of the emerging and disruptive technologies. At the moment, there exist numerous definitions of artificial intelligence.Some of the definitions are as follows:

McCorduck (2004) described AI as intelligence exhibited by machines in distinction to normal intelligence demonstrated by humans and other animals. Poole and Mackworth (2017) see AI as 'computational systems that perform tasks commonly viewed as requiring intelligence.' Artificial intelligence technologies are utilized to erect business processes, appreciably enhancing operational performance (Bezos Letter to Shareholders, CNBC, 2017). Zhou, Fu and Yang (2016) noted that, artificial intelligence possesses the capability of a computer or computer-controlled robot to act upon tasks usually related with intelligent beings. This study perceives AI as scientific mechanisms' utilized to make a replica of humans' cognitive aptitudes to accomplish objectives independently. Artificial intelligence (AI) can also be perceived as, the modeling of human intelligence in machines that are programmed to reason like humans and imitate their actions. This implies that machines can be prepared to execute responsibilities usually linked with intelligent beings like humans and animals. The expression may also be applied to whichever machine that displays behavior linked with a human intellect such as learning and problem-solving.

Hence, AI and its technologies (machine learning, deep learning, chatbot, neural network, virtual assistant and others) are basicallyremodeling the business and organizational processes of companies (CIGREF, 2018; Pwc, 2019). Candidly, AI has by now transformed the general configuration of organizations and the relation with their environment. AI has single-minded a new way of managing information, and this correspond to both a challenge and an massiveopening for organizations; but grabbing hold of this opening necessitates a transformation in culture, frame of mind and proficiency (Di Francescomarino & Maggi, 2020; Lee *et al.*, 2018; Sikdar, 2018).

Organizational Performance

Performance is a sweeping meter which assimilates productivity and quality, uniformity and other factors (Ikegwuru & Acee-Eke, 2020). Organizational performance connotes how healthy an entity is realizing its definite goals by means of the resources accessible at its disposal. Mohammadpoor and Torabi (2019) assert that, it is imperative to measure performance on a consistent basis to ascertain how well preset objectives are realized. One of the genuine ways an organization can footpath its performance over time is the development of Key performance indicators (KPIs), which are meters that support organizations to guarantee that objectives are specific, measurable, achievable, relevant to organizational mission, and timely (SMART).

While objectives are traditionally measured in financial terms, there is a growingresponsiveness on the necessity to spotlight on non-financial performance indicators. A well-knownstructureon

performance measures that de-accentuates the extremespotlight on financial performance is the balanced score card. Navickas and Gruzauskas (2016) illustrate that, the balanced score card highlights three non-financial performance viewpoint (customer, internal business process, and product development/learning andgrowth)at the same time as tolerating the significance of the financial viewpoint. The balanced scorecard consequently is composed of four perspectives of customer, internal business process, product development/learning and growth, and financial. Nevertheless, the non-financial viewpoints are reflected on as more significant than the financial viewpoint because they decide the extent of economic/financial success of a business. It turn out to be imperative for organizations to set up artificial intelligence to appraise performance from these four scopes to rationalize the value relevance of changing from a manual method to an automated system powered by artificial intelligence.

Artificial Intelligence and Organizational Performance

If organizations comprehensively deploying AI are capable of achieving enhanced performance in the four performance dimensions as projected by the balanced scorecard above, it will be able to catch the attention of more customers and investors, thereby deriving competitive advantage. However, a company extensively deploying AI may be able to sustain its competitive advantage. Sustainable Competitive Advantage) if it maximizes the benefits from the software. Meanwhile, Sumbal, Tsui and See-to (2017) refer to sustainable competitive advantage as the capacity of a business to constantly improve and uphold an above-industry/sector-average performance in the short-term, medium-term and long-term.

Al applications can be installed on hand-held device and reachable on mobile devices and desktop applications (Rasmussen & Ulrich, 2015). This understanding is expected to develop a collaborative and vigorous communication arrangement. Al software can as well supply priceless prospect for organizations to sustain a vigorous database of customers which can be valuable for building up big data and executing business analytics to enhance service delivery (Spenner & Freeman, 2012; Searle, 2006).

Automation of operations in businesses, including the accounting processes and invoice management contributes to appropriate record keeping, reliability of costing jobs, correct pricing and timeliness of disclosing accounting reports (Steenbruggen, Tranos & Nijkamp, 2015). Automation is also projected to trim down operating cost in the long run. Automation may lessen the number of employees required to work because non-core activities that have previously been performed by means of human intervention can be eradicated, as the business focuses on core activities. Automation also boosts efficiency by dipping the time necessary to complete tasks which condense labour costs and related expenses. The learning consequence emanating from automation also has the possibility of plummeting wastage and ineptitude in the business process. This brings into being cost saving and build up the profitability of the business (Stuart & Norvig, 2016).

The multiplicity, quantity and rapidity of data engendered each day by means of electronic device also entail that machines would have to be depended upon to obtain inputs, process transactions and produce output for goods and services (<u>Sumbal, Tsui, & See-to, 2017</u>). This implies that

operations have need of physical human intervention need to be automated, and AI is a modernism foremost in this direction (Werner & Gehrke, 2015). It becomes obvious that, machine would have to be depended upon to assume human interaction as sustained by the notion of artificial intelligence.

There exist some studies on implementation of AI application in organizational performance for realizing flourishing modernism. For example, Bag *et al.* (2020) found that artificial intelligence influences firm's value significantly; Mikalef and Gupta (2021) revealed that artificial intelligence proxies have a positive influence on organizational performance. Other studies have acknowledged analogous findings, for example, AI powers business flexibility and performance (Mishra & Pani, 2020; Liu *et al.*, 2020, Rout *et al.*, 2018; Mikalef & Pateli, 2017), AI as an amplifier of an intrapreneurship culture (Mikalef & Krogstie, 2020; Benitez, Llorens-Montes & PerezArostegui, 2010), AI as a technique to curtail trade-offs (Goh & Arenas, 2020). Therefore, artificial intelligence implementation is predictable to enhance organizational performance because the application will have an organizational interface where companies can log in to keep an eye on the status of their current business, make enquiries, bring up to date their customers' requests, exchange correspondences, attend to customers complaints and even get their business rated by customers.

Empirical Review

The empirical review documents recent studies that showcase the effect of AI implementation on organizational performance.

Mikalef *et al.* (2023) examines AI capabilities and organizational performance by means of a survey-based study. Data was gathered from European public organizations concerning the indirect effect AI capabilities have on organizational performance. Data was composed from 168 municipalities from three European countries (Norway, Germany, and Finland) and analyzed using structural equation modeling. Findings demonstrate that AI capabilities have a positive effect on process automation, cognitive insight generation, and cognitive engagement. Whereas process automation and cognitive insights have a positive effect on organizational performance, It was also found that cognitive engagement negatively affects organizational performance.

Mikalef et al. (2023) developed a conceptual research model that explores the influence of AI competencies on B2B marketing capabilities and organizational performance by using 155 survey responses from European companies and analyzed by means of partial least squares structural equation modeling. The results emphasize the mechanisms through which AI competencies influence B2B marketing capabilities, as well as how it afterward influences organizational performance.

Agarwall, Das and Swain (2021) investigated the influence of AI on operating performance of companies in different sectors in India. The difference in operational performance was assessed in pre and post AI era. In the study, the artificial Intelligence is measured by the variables such as computer hardware and intangibles (computer software etc.). The operating profit and operating

cost was adopted as the proxy variables for operational performance of companies. The study employed secondary data gathered from the annual reports of sample companies from the year 2004 to 2018. The sample companies under study consist of of manufacturing, telecommunication, and IT companies. The statistical software i.e., Ms. Excel and EViews 10 was used to analyze the t-test and panel regression model for statistical inferences and theoutcome illustrated that artificial Intelligence has a significant influence on companies operating cost as well as operating profit.

Iwuanyanwu (2021) investigated the institutional factors affecting the application of Artificial Intelligence (AI) by American companies, using a population comprised of all publicly quoted companies on NASDAQ (National Association of Securities Dealers Automated Quotations). 330 companies were randomly drawn, and a copy of questionnaire sent out to each company, making a total of 330 copies of questionnaire administered. The result confirms that the relatively high-ranking institutional factors affecting AI application are Competitors' activities, Consultants/Professional bodies, actions of Multinational organizations, and the need to satisfy customers. A thematic analysis of the high-ranking factor demonstrates that the mimetic factors are the strongest factors driving the application of AI by the companies. The normative factor also has significant influence on AI application. The findings also depicts that institutional factors that the application of AI application in American companies. Findings suggest that the application of AI has a significantly positive impact on organizational competitiveness.

Al-Walai and Liang (2021) examined the impact of artificial intelligence on management and leadership in research and development by means of a single and holistic case study on the organization Thermo Fisher Scientific.The study used multiple sources of data as well as both primary data from multiple interviews and secondary data in the form of publicly available data.A theoretical dynamic model was produced for explaining the extent to which mechanism of Al predicts or twists R&D by means of grounded theory based on empirical interview data analysis. Interesting findings shed light on importance of implementation of Al application in R&D. The findings disclose that Al application in R&D can lead to higher efficiencies in processes, decision making, costs and fuel innovation, whereas a shift of leadership elements and organizational structure changes can be expected.

Zehong and Zheng (2018) considered the impact of artificial Intelligence on accounting fraud and accounting information quality and found that Artificial Intelligence help to vanish the accounting frauds and also enhance the quality of accounting information.

METHODS

This study adopts a survey research method in a non-contrived setting (downstream oil and gas companies). The deductive approach with the positivist stance of research philosophy was adopted. The population of this study is drawn from the eleven (11) mainstream oil and gas companies which are quoted on the Nigerian Stock Exchange and the population is also assumed as the sample size, since it is less than 30. The simple random sampling technique was adopted to draw one hundred and seventy-six (176) respondents for the study, on a sample frame of sixteen (16) respondents per firm. A structured questionnaire anchored on a five point likert scale

ranging from strongly disagreed to strongly agree was adopted. to test the cause-effect relation between two or more variables than other statistical methods like non-parametric tests. In this study, descriptive analysis was presented with a view to emphasizing the reliability and validity of estimates obtained.

RESULTS

Data were collected through a 12 item questionnaire administered to the respondents. Subsequently, one hundred and seventy-six (176) copies of the questionnaire produced were distributed to the respondents. Out of the 176 copies issued, 168 representing 95% were retrieved while 8 copies representing 5% were not retrieved. Further to achieving cross-sectional balance across cloud type, 7 of the retrieved copies were discarded.

AI and					Non=Resp	Retained				
Organizational	Quest.		Response	Not	onse Rate	for				
Performance	Issued	Retrieved	Rate (%)	Retrieved	(%)	Analyses				
	176	168	95	8	5	168				
Total	176	168		8	5	168				

Table 1: Questionnaires Administered and Retrieved

Source: Field Report, 2023.

The data in Table 1 were systematically analyzed based on the quality of response obtained, using designation status of the respondents as yardsticks.

Designation of Respondents	Frequency	Percentage (%)		
Managing Director (MD)	38	23		
Deputy Managing Director (DMD)	45	27		
General Manager (GM)	25	15		
Business Unit Manager (BUM)	24	14		
Head of Department (HOD)	17	10		
Supervisors	19	11		
Total	168	100		

Table 2: Designation Status of Respondents

Source: Survey Data, 2023



Figure 1: Bar Chart Distribution of designation of respondent Source: (SPSS output of Data, 2023)

An analysis of designation composition of respondents as shown in the Table 1 and figure 1 depict that 23% of the respondents occupied the managing director (MD) positions within the period of the study, 27% are of the Deputy Managing director (DMD) category; whilst 15% and 14% occupied the General Manager and Business Unit Manager positions respectively. However, 10 and 11% of the respondents belonged to the head of departments and supervisors cadre within the period of the study.

The result in Table 3 shows that the mean differences between components of tax incentives and foreign direct investment are high and significant, thus providing a clue of a positive association between components of tax incentives and foreign direct investment.

Descriptive Analysis

This study investigates the association between artificial intelligence implementation and organizational performance by means of descriptive analysis of relevant variables with a view to emphasizing the reliability and validity of estimates achieved. The descriptive findings of the interaction of artificial intelligence implementation and organizational performance are reported in Table 3. The relationship between artificial intelligence implementation and organizational performance was investigated by testing the significance of their mean differences and standard deviations.

Respondents were asked to indicate their opinion against each of the statements using five-point Likert-scale, anchored on 1= strongly disagree to 5 = strongly agree). Results from each of the items on artificial intelligence and organizational performance are presented in Table 1. On the average, respondents' collective opinion summed up at 4.3 on the 5-point Likert scale. This indicates an affirmation of high predominance of artificial intelligence and organizational performance. As suggested by the result from Table 1 (item 6), the highest prevalence of artificial intelligence and organizational performance intensity is mostly attributed to the alignment sustained AI implementation by a company can smarten up and sustain its dynamic potentials for enhanced organizational performance. Item-6 is the highest while item 11 is the least prevalent factor in artificial intelligence implementation association with organizational performance.

The overall standard deviation suggests moderate variability of artificial intelligence implementation and organizational performance among the respondents. A factor which can be attributed to discrepancy in implementation of artificial intelligence which can fix up organizations explicit processes, launch, direct and sustain the dynamic potentials of the given organization for enhanced organizational performance.

Items	Mean Score	Std Dev	Verdict
Artificial Intelligence can be adopted to realize modernism in organizational performance	4.3	1.2	Agree
Artificial Intelligence needs to be considered as a significant building block in the growth of business.	4.2	0.7	Agree
Artificial Intelligence is the digital technology that must be transported simultaneously to make easy enhanced organizational performance	4.3	0.7	Agree
Organizations need to take advantage of AI's capacity to remain feasible.	4.1	0.8	Agree
Al implementation enhances organizational performance and generates competitive advantage.	4.6	0.6	Strongly Agree
Al implementation can refurbish and sustain the dynamic potentials of a company for enhanced organizational performance.	4.7	0.8	Strongly Agree
Artificial intelligence as an information technology is positively linked with organizational performance.	43	0.7	Agree
Al implementation can contribute to appropriate record keeping, reliability of costing jobs, correct pricing and timeliness of disclosing accounting reports	4.3	0.8	Agree
Al implementation can trim down wastage and ineptitude in the business process.	4.3	0.6	Agree
Al implementation entails that machines would have to be depended upon to obtain inputs, process transactions and produce output for goods and services.	4.6	0.6	Strongly Agree
Artificial Intelligence is an amplifier of an intrapreneurship culture	39	1.0	Agree
Application of AI will ensure an organizational interface where companies can log in to keep an eye on the status of their current business.	4.3	0.9	Agree
Aggregate	4.3	0.8	Agree

Frequency

Based on a five-point Likert scale, the average aggregate opinion of respondents as presented in Table 3 summed up to 4.3. This shows a substantiation of high pervasiveness of artificial intelligence implementation. According to Kothari (2016), the point to which all items used in measuring a variable co-vary in the equal direction is referred to as uni-dimensionality. To arrive at the uni-dimensionality of the twelve items of artificial intelligence implementation and organizational performance, a confirmatory factor analysis was performed. The orthonormal loading bi-plot as symbolized in figure 2 depicts that only one of the first two derived components explains 98.6 per cent of the total variance, with an Eigen value of 11.832.





The Cronbach's alpha of 0.891 for the entire twelve items designates an acceptable level of internal reliability. Since the preceding statistics specify high degree of reliability and validity of measurement, the estimated principal component can properly serve as an indication that artificial intelligence implementation significantly associates with organizational performance.

DISCUSSION

From the results obtained, it can be observed that artificial intelligence implementation has a significant relationship with organizational performance of the mainstream oil and gas sector of Nigeria. It implies that artificial intelligence espousal has a significant linkage with companies operating cost as well as operating profit, and will equally eliminate accounting frauds and enhance the quality of accounting information. Artificial intelligence, as a digital technology is a significant building block in the growth of business, and can be adopted to realize modernism in organizational performance and generate competitive advantage for companies and power them to remain feasible in the contemporary and dynamic business landscape. This is in line with Agarwall *et al.* (2021) who found that, artificial Intelligence has a significant influence on companies operating cost as well as operating profit, Al-Walai and Liang (2021) who disclosed that artificial intelligence application in research and development (R&D) can lead to higher efficiencies in processes, decision making, costs and fuel innovation, and Zehong and Zheng

(2018) who illustrated that, artificial Intelligence helps to vanish the accounting frauds and also enhance the quality of accounting information.

These results suggest that artificial intelligence implementation has a significant positive impact on organizational performance. This makes it convincing to encourage investment in artificial intelligence by mainstream oil and gas companies given its significantly positive impact on organizational performance.

CONCLUSION AND RECOMMENDATION

This study investigated artificial intelligence implementation and organizational performance in the Nigerian mainstream oil and gas sector. Artificial intelligence envelops a wide range of technologies, together with machine translation, chat bots and self-learning algorithms, all of which can allow individuals and companies to better appreciate their environment and act in view of that. This study in the analysis of the nexus between artificial intelligence and organizational performance found that, the overall standard deviation suggests moderate variability of artificial intelligence implementation and organizational performance among the respondents. The study therefore, concludes that artificial intelligence implementation significantly associates with organizational performance of mainstream oil and gas companies in Nigeria, and recommends that, management of mainstream oil and gas companies should implement AI capabilities to generate higher efficiencies in processes, decision making, costs and fuel modernism to attain optimal organizational performance.

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