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ARTIFICIAL INTELLIGENCE (AI) AND EFFICIENCY OF BUSINESS OPERATIONS

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Abstract
This research delves into the multifaceted impact of AI on the efficiency of a country's business landscape. It explores how AI-driven technologies through high technology adoption, mobile cell subscription and public private partnerships impact business efficiency in the Gambia and Nigeria business environment. To achieve the objectives of this study, multiple regression technique was employed to provide a comprehensive overview of AI's impact in shaping the business environment's efficiency, offering valuable insights for policymakers, business leaders, and stakeholder. The differences in the impact of artificial intelligence adoption and subscription among the two countries do not undermine the significance of the general applications of AI to promoting business efficiency globally. This study recommends the need to embrace the high-tech adoption, increase in mobile subscription and public private partnership as components of AI in boosting global business efficiency.
Keywords: Artificial intelligence, Business efficiency, Public private partnership and Mobile cell subscription

Introduction

To optimize and automate business operation thereby enhancing efficiency and boost productivity has prompted inquisitiveness and innovations. This led to the creation and use of artificial intelligence (AI) technology such as machine learning for various commercial purposes. This sparked debate among academics, industry professionals, legislators, etcetera (Devaraj & Kohli, 2003; Nwamen,2006). Vazquez and Goodwin (2024) referred to an artificial intelligence in business as the use of tools of AI like computer vision, language processor and machine learning to enhance business operations and boosting the productivity of the workers and the overall business outcomes. It is general term that encompasses the use of a computer to model intelligent behaviour with negligible human involvement (Benko & Lányi, 2009; Heinlein & Kaplan, 2019; McCorduck, Minsky, Selfridge, & Simon, 1977). To achieve the objective of this study, Foreign Direct Investment (FDI) was used to measure business efficiency as the outcome variable, Public Private Partnership investment on ICT, high technology subscription and the use of mobile cellular with access to artificial intelligence with emphasis on cost and satisfaction. This study aims to investigate how businesses in sub-Saharan Africa, particularly in the Gambia and Nigeria, are affected by the development of artificial intelligence (AI) to improve their business efficiency in terms of operational cost, performance, and employment. Given the importance of AI solutions in modern business and educational practices, this research is undertaking to fill the gap in the parlance of Artificial Intelligence by looking at the impact of AI contribution to business efficiency.

Besides, to find out the expanses where AI has the greatest influence and the current barriers and constraints businesses are experiencing in their efforts to leverage the potential of AI. By means of the expected results of this study and need to improve business efficiency, it is possible to attract attention to the necessity of considering empirical evidence thereby increasing the knowledge base, which possibly helps make decisions and implement strategies for AI usage in the business sphere. Despite the wide applications of Artificial intelligence in every aspect of human activities, there are still few extensive researches that are focusing on how these technologies are transforming into concrete improvements of business operations and organizational outcomes especially the west African countries (Blanchet, 2016; Lee et al., 2018; Wiljer& Hakim, 2019; Zhong, 2008).Some useful breeds of AI include the following: Robotic process automation, which enhances efficiency by automating the execution of repetitive tasks; machine learning, which also enhances the efficiency and enables the making of more effective decisions; natural language processing, which assists in simplifying the operations (Zmud, et al.,1979; Owolabi et al., 2021). The impact of AI on the operations having more efficiency specifically in the corporate environment

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of developing nations is still an area of explorations (Davis, 2005; Hooker & Kim Tae, 2019; Schweitzer & Puig-Verges, 2018).

It is the intention of this research to evaluate the impact of AI on the efficiency of the business environment in Gambia and Nigeria. These two West African nations have recently demonstrated a keen willingness and desire to use AI as a tool to enhance the delivery of some of their vital services or functions (Buchanan, 2005; [Pwc], 2019; Yoav, 2018). The creation of computer systems that are able to carry out operations that normally require human intellect, including as voice recognition, visual perception, decision-making, and language translation, is known as artificial intelligence (AI) robots (Gabrilovich & Markovitch,2009). Business Environment Efficiency as defined by Golicic and Davis (2012) relates to the ability of an organisation to manage the operations and procure resources and control costs and produce the maximum number of goods or services in a specific economic and business context.

Empirically, several researches have observed how artificial intelligence affects a country's business environment, and productivity level (Zhong,2008). In industrialised nations. Brynjolfsson and McAfee (2017), for example, discovered that businesses who adopted AI saw notable increases in productivity and enhanced decision-making procedures. Similar to this, Basu et al. (2021) found that the industrial sector's use of AI boosted cost savings and operational efficiency. Research on AI's effects in emerging nations is, nonetheless, scanty. In their investigation of the possibilities of AI in Nigeria's financial industry, Owolabi et al. ,(2021) noted a number of obstacles, including limited infrastructure and a shortage of trained labour. In their study, Akpan et al.,(2020) examined the use of AI in Gambian agriculture and emphasised the necessity of capacity building and policy interventions. The theoretical frameworks to facilitating the understanding of how AI affects the effectiveness of the business environment include the Technology Acceptance Model (TAM) developed by Davis (1989). This model describes the elements that affect how new technologies are adopted and used, such as perceived ease of use and utility. Another is the Diffusion of Innovations Theory (DIT) by Rogers (2003). This theory takes relative advantage, compatibility, and complexity into account when describing how new innovations or technology are embraced and dispersed within a social system. Besides, the knowledge of Resource-Based View (RBV) (Barney, 1991) theorises that a company's competitive edge stems from its distinct resources and competencies, encompassing both technology and knowledge-based resources.

To Installing and implementing solutions of artificial intelligence could be problematic for various business organizations in Africa. The effective incorporation of AI into company procedures can be hindered by fundamentals inadequate infrastructure, scarcity of experienced workers, and restricted access to data. To encourage the efficient use of AI technologies and identify areas for development, it is important to comprehend the present status of AI adoption and its influence on corporate efficiency in African countries. Furthermore, there is a dearth of empirical data about the variables that affect the effective integration of AI technologies and how they affect several facets of corporate efficiency, including decision-making foreign investment, productivity, and cost optimization. How much can AI influence to increase foreign direct investment is a case to observe and study. Therefore, the study hypothesised that artificial intelligence do not have significant impact on the business efficiency in the west Africa countries especially the Gambia and Nigeria.

Research Objectives

It is the objective of this research to examine how AI adoption influences the efficiency of the business environment in the West African region includes Nigeria and the Gambia. To actualize the objective of this study, the effects of AI's indicators like level of high-tech adoption, mobile cell subscriptions, and public private partnership investment in information technology on business efficiency were specifically examined.

Research Hypotheses

The underlying null hypotheses were formulated to test the significance of the effect of AI adoption on the efficiency of business operations.

Hypothesis 1(H_{01}): The implementation of AI systems has no significant impact on the efficiency of business operations in the Gambia.

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Hypothesis 2(H_{02}): The level of public private partnership investment in AI does not significantly influence the efficiency of business operations in the Gambia.
Hypothesis 3 (H_{03}): The implementation of AI systems through the level of mobile subscription has no significant impact on the efficiency of business operations in Nigeria.
Hypothesis 4 (H_{04}): The level of public private partnership investment in AI does not significantly influence the efficiency of business operations in the Nigeria.

Methodology

This study utilised ex post facto research design which utilises historical data. This approach was chosen in this study owing to it convenience in gathering quantitative data and enhancing quantitative analysis of the impact of artificial intelligence on the efficiency of business operations. The historical data on AI indicators like hitec adoption, mobile cell subscription, and private public partnership in information technology drawn from the businesses environment in the Gambia and Nigeria were focused. To realise the objectives of this study a multiple regression techniques was employed. The Gambia and Nigeria, two West African nations and emerging economies in the sub-Sahara African were focused on in this study. The attractions to these countries stemmed from their advancement in the implementation of information technology most especially artificial intelligence (AI) in the promotion of business operations for efficient productivity.

Specification of Model

To capture the impact of AI adoption on the business efficiency operations, the following multiple regression model and a priori expectation of variables was specified as thus:
$$Business\ Efficiency\ (FDI) = \beta 0 + \beta 1 tech(AI) + \beta 2 cellular + \beta 3 ppp + \varepsilon$$
Where:
BE Efficiency (Foreign Direct Investment) = Foreign Direct Investment as measure of Business Environment Efficiency.
Tech = High technology subscription
Mobile cellular = The number of people (per 100) using mobile (smart phone) with access to AI.
PPP = Public Private Partnership investment on ICT
ε = Error Term
Based on the theoretical framework and existing literature, the following prior expectations are proposed:
$\beta 1 > 0$: Higher level tech (AI) adoption is expected to have a positive impact on business environment efficiency.
$\beta 2 > 0$: The higher the usage of mobile technology by companies and individuals will have a positive impact on business environment efficiency.
$\beta 3 > 0$: Public Private Partnership on ICT is expected to impact business environment efficiency positively.

Variable Description

Business Environment Efficiency (BE Efficiency): This dependent variable will be measured using a composite index that considers factors such as Foreign Direct Investment, productivity, cost optimization, decision-making processes, and overall business performance. High-technology (AI Adoption): This independent variable will be measured using a scale that captures the extent to which businesses have implemented AI technologies in various areas of their operations, such as customer service, data analysis, and process automation. Mobile cellular: This independent variable will assess the level of preparedness and usage of cellular phones within organizations for AI implementation, including factors such as the usage of mobile and mobile related technology on organization's decision making. PPP investment in ICT: This independent variable will measure the availability of how much is been invested by both the public and private sector with relevant knowledge and expertise in ICT and related technologies within the business environment of the country.

Data/Sources

The study will collect secondary data through a World Bank website to businesses in Gambia and Nigeria. The integration of Artificial Intelligence (AI) technologies into business operations has garnered significant attention due to its potential to enhance efficiency and productivity. As organizations increasingly embrace AI systems, it is crucial to understand their impact on the business environment and evaluate their

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effectiveness in achieving operational excellence. This literature review explores the existing research on assessing the impact of AI on business environment efficiency. The study employs various analytical techniques to address the research questions and hypotheses. This includes quantitative analysis like multiple regressions, analysis of variance (ANOVA) techniques to determine the impact of AI indicators on the business efficiency in the Gambia and Nigeria business environments.

Results

Summary of Descriptive Statistics for the Gambia

Table 1. ***Summary of Descriptive Statistics(Gambia)***

Variable	Observation	Mean	Std.Dev.	Min	Max
FDI	10	7.17	4.55	1.90	2.30
HIGH TECH. Adoption	10	1.17	1.46	0.00	4.04
Mobile cell subscription	10	104.02	21.22	70.12	130.12
PPP Invest.	10	-.71	1.23	-4.13	-0.00

Note: Author's computations, 2024, using stata

Table 1 demonstrates the descriptive statistics of showing the behaviour of the variables used in the study in relation the Gambia business environment. The mean value of the foreign direct investment (FDI) in Gambia is 7.17 with minimum value of 1.90 and maximum value of 2.30. The standard deviation is 4.55 depicting high variability of business efficiency proxied by foreign direct investment in the Gambia. The estimated mean of the high technology adoption is 1.17 with minimum and maximum value of 0.00 and 4.04 respectively. The high technology exposure in the Gambia indicated a low variability indicating a relative stability in the degree of AI technology exposure in the Gambia. Mobile cell subscription in the Gambia had a mean value of 104.02 with minimum and maximum values of 70.12 and 130.12. The level of deviation as measured by the standard deviation is 21.22. The mean value of the public and private partnership investment was very low in the Gambia as demonstrated by the absolute value |-0.71|with standard deviation of 1.23.

Table 2. *Analysis of Variance(ANOVA) Results*

Note : Author's computation, 2024 using Stata

Table 2 illustrated the analysis of variance results which compare the effects of artificial indicators on the business efficiency in the Gambia. The results revealed that there is no statistically significance difference in the mean of the 3 indicators (F(3,6) = [0.21], P= 0.88) of the AI on the business efficiency proxied by the foreign direct investment in the Gambia. This was confirmed by the R-squared (0.09) indicating that the overall fitted regression model only explains about 9% variation in the business efficiency in the Gambia.

Source	Observation	Sum of square	Df	Mean square	F	Prob. (Sig)
Model	10	1.75	3	5.86	(3, 6) , 0.21	0.88
Residual	10	1.68	6	2.81		
Total		1.86	9	2.07		
R-Squared		0.09				
Root MSE		5.3				

Test of Hypothesis 1(H_{01}): The implementation of AI systems has no significant impact on the efficiency of business operations in the Gambia.

The result of the multiple regression analysis was used to provide insight into the relationship between AI adoption and business efficiency in the Gambia.

Decision Rule: If the coefficient for AI adoption is statistically significant and positive, it will support the hypothesis that AI implementation contributes positively to business efficiency in the study regions. Alternatively, if the coefficient is insignificant or negative, it may suggest that AI adoption does not necessarily lead to increased efficiency or that there are other factors that influence the efficiency of business operations. Therefore, from table 3, the results revealed that AI adoption was not statistically significant in the Gambia. Given this, there was no insufficient evidence to reject the null hypothesis that AI implementation has significant impact on the efficiency of business operations in the Gambia.

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Test of hypothesis 2 (H_{02}): The level of public private partnership investment in AI does not significantly influence the efficiency of business operations in the Gambia.

Decision Rule: If the coefficient for public private partnership investment in AI appears statistically significant and positive, support will be led to the alternative hypothesis that AI implementation contributes positively to business efficiency in the study regions. Alternatively, if the coefficient is insignificant or negative, it may suggest that the level of public private partnership in AI adoption does not necessarily lead to increased business efficiency in Gambia. This implies that there are other factors that could responsible for the business efficiency operations in the Gambia. Therefore, the results in table 3 revealed that public private partnership investment in AI does not significantly influence the efficiency of business operations in the Gambia. To this end, this study failed to reject the null hypothesis since there is no adequate evidence to justify it.

Table 3. ***Regression Result (Gambia)***

Note: Author's Computation, 2024

Table 3 shows the fitted regression model's coefficient. It was found that high technological adoption (HitecAdopt.) do not significantly predict the business efficiency (-11.97, p= > 0.05). The mobile cell subscription though positive but do not significantly predict the business efficiency in the Gambia as depicted by the coefficient and p-value (3.29, P= > 0.05). In the case of the public private partnership investment (PPP Invest = 4.42, P> 0.05) indicating positive effect but do not significantly predict the business efficiency in the Gambia. The overall results revealed that AI's indicators (Hitec Adoption, Mobile cell subscription, and PPP Investment) used to investigate the impact on artificial intelligence on business efficiency in the Gambia do not show any significance effects. This provides a sufficient evidence

Variables	Coef.	Std. Err.	T	P>|t|	[95% Conf. Interval]	
Hitech adoption	-11.97	1.58	-0.08	0.94	-3.99	3.75
Mobile cell subscription	3.29	11.89	0.28	0.79	-2592	3240
PPP Invest.	4.42	1.46	0.30	0.77	-3.13	4.01

and justification not to reject but to support the null hypothesis that the implementation of artificial intelligence (AI) does not significantly impact the efficiency of business operations in the Gambia. This revealed a poor effect of artificial intelligence on the business environment in the Gambia.

In the same vein, the information revealed by the study was not sufficient enough to reject the null hypothesis number two (H_{02}) which postulated that the level of public private partnership investment in AI does not significantly influence the efficiency of business operations in the Gambia as illustrated in table 3. This informed the failure to reject the null hypothesis otherwise led support to the null hypothesis, indicating that non significance of public private partnership in information technology as an indicator to represent artificial intelligence impact on efficiency business operations in the Gambia.

Table 4. ***Descriptive Statistics (Nigeria)***

Variable	Observation	Mean	Std.Dev.	Min	Max
FDI	10	4.06	2.48	7.75	8.84
HIGHTECH. Adoption	10	3.51	3.35	1.26	11.90
Mobile cell subscription	10	78.86	11.84	57.51	98.03
PPP Invest.	10	-0.71	1.23	-4.13	-0.00

Note: Author's Computation, 2024 using stata

Table 4 demonstrated the descriptive statistics results of the variables in relation to Nigeria. The results revealed that the mean of the foreign direct investment (FDI) representing the business efficiency in Nigeria is 4.06 with minimum and maximum values 7.75 and 8.84 respectively. The degree of deviation of the business efficiency proxied by FDI was 2.48 lower than that of Gambia with Standard deviation of 4.55 as illustrated in table 4 indicating a stable impact of artificial intelligence (AI) utilisation on the business efficiency environment in Nigeria than The Gambia. The mean of the high-tech adoption was 3.51 with

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minimum and maximum values of 1.26 and 11.90 respectively. The standard deviation was 3.35 indicating high degree of tech adoption compare to Gambia with relative low-tech adoption as can be gleaned from the Gambia standard deviation of 1.46. The mean measurement of mobile cell subscription was 78.86 with minimum and maximum values of 57.51 and 97.03 respectively. The standard deviation of 11.84 was recorded which is relatively low compare to the Gambia standard deviation of 21. 22. This implies that, there is a more stable in the mobile cell subscription in using AI in Nigeria than the Gambia. The public private partnership investment in AI technology showed a mean measurement of absolute value of -0.71 with minimum and maximum absolute values of -4.13 and -0.00.

Table 5. ***Analysis of Variance* (*ANOVA) Results (Nigeria)***

Source	Observ Ation	Sum of square	Df	Mean square	F	Prob. (Sig)
Model	10	4.17	3	1.39	(3, 6), 6.14	0.02
Residual	10	1.35	6	2.66		
Total		5.52	9	6.14		
R-Squared		0.75				
Root MSE		1.5				

Note: Author's Computation, 2024 using Stata

To measure the statistical difference between the means of the variables of artificial intelligence in Nigeria, the analysis of variance was used as demonstrated in table 5. The results revealed that there is statistically significance difference in the mean of the 3 indicators. This is contrary to the non-statistical difference in the mean of indicators in respect of the Gambia. This was demonstrated by the estimate (F(3,6) = [6.4], P= 0.02). The model in the case of Nigeria showed a well fit as about 75% of the variation in the business efficiency is accounted for by AI indicators (High-tech adoption, Mobile cell subscription, and public private partnership investment).

Test of hypothesis 3 (H_{03}): The mobile subscription has no significant impact on the efficiency of business operations in Nigeria.

Decision Rule: If the coefficient for mobile subscription is statistically significant and positive, it will support the hypothesis that mobile subscription contributes positively to business efficiency in the business operations in Nigeria. Alternatively, if the coefficient is insignificant or negative, it may suggest that mobile subscription does not necessarily lead to increased efficiency business operations in Nigeria. The study revealed that mobile subscription in Nigeria is statistically significant but negative indicating the importance of artificial intelligence but with added cost of doing business in the Nigeria business operations as indicated in table 6. This study rejects the null hypothesis and upheld the alternative since there is adequate information revealing the significant impact of mobile subscription on the business operations in Nigeria.

Test of hypothesis 4 (H_{04}): The level of public private partnership investment in AI does not significantly influence the efficiency of business operations in the Nigeria

Decision Rule: If the coefficient for public private partnership investment in AI appears statistically significant and positive, support will be led to the alternative hypothesis that AI implementation contributes positively to business efficiency in the study regions. Therefore, from table 6, it was revealed that coefficient of ppp investment was positive and statistically significant. This provides adequate information to reject the null hypothesis and upheld the alternative and concludes that public private partnership investment (ppp invest.) in AI driven technology promotes business efficiency in Nigeria.

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Regression Results (Nigeria)

Source: Author's Computation, 2024

Table 6 shows the fitted regression model's coefficient in respect of Nigeria. It was found that high technological adoption (Hitec Adopt) do not significantly predict the business efficiency given its p-value of 0.86 which is greater than p-value of 0.05 (5%) level of significance. Though, a unit change in the high-tech adoption led to about 2.98 variations in the business efficiency in the Nigeria business environment. The mobile cell subscription though negative but significantly predict the business efficiency in the Nigeria as depicted by the coefficient and p-value (-1.77, P= < 0.05). In the case of the public private partnership investment (PPP Invest = 1.78, P< 0.05) indicating positive effect and significantly predict the business efficiency in the Nigeria. The overall results revealed that AI's indicators used to investigate the business efficiency in the Nigeria showed significance effects, revealing efficiency of artificial intelligence on the business environment in Nigeria.

Variables	Coef.	Std. Err.	T	P>|t|	[95% Conf. Interval]
FDI(DEP)					
Hitech adoption.	2.98	1.62	0.18	0.86	-3.66 4.25
Mobile cell subscription	-1.77	4.88	-3.63	0.01	-2.97 -5.78
PPP Invest.	1.78	3.82	4.65	0.00	3.44 2.72

Discussion of Findings

Intelligence tools like AI are game changer in business world has varying impact on the economies. With AI on a high-tech country in Nigeria and the Gambia, it is expected that business operations and productivity of those countries enhanced. Also, AI-driven tools can increase efficiency, improve decision-making by analysing large amounts of data, and lead to the creation of new products, services, and industries. These overall positive impacts of AI tools would lead to improvement of business efficiency operations as captured by the foreign direct investment.

Therefore, the findings of the study revealed that the indicators representing AI tools in the Gambia were found to be non significant in influencing the efficiency of business operations in the Gambia. This was illustrated by the test of two hypotheses (hypothesis 1 &2); the implementation of AI tool was documented to have no significant impact on the efficiency of business operations in the Gambia. It was gathered from the findings hypothesis testing that the level of public private partnership investment in AI does not significantly influence the efficiency of business operations in the Gambia. In the case of the adoption of hitec in the Gambia as components of AI-tools, it was discovered from the regression estimate, a negative a non-statistical significant impact of hitec adoption or implementation of artificial intelligence tools on the efficiency of business operations in the Gambia.

On the other hand, in the case of Nigeria, the study revealed that mobile cell subscription and public private partnership of the three indicators of the artificial intelligence tools were found to be statistically significant, while the hitec adoption or implementation was found to be non statistically significant. Of the two significant indicators, mobile cell subscription was found to have negative influence on the efficiency of business operations in Nigeria. This implies that despite the significant of the artificial intelligence tools for optimizing business operations, the cost implications of AI-driven technology could impact on business operations negatively most especially small scale businesses. Besides, the findings documented public private partnership investment in information technology AI-driven technology to positively and significantly influence the efficiency of business operations in Nigeria. This underscores the significance of public and private partnership in the provision of infrastructural development like information technology in enhancing efficiency of business performances in emerging economies like that of Nigeria and the Gambia.

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Conclusion

In conclusion, the study documented that the impact of artificial intelligence-driven tools in promoting efficiency of business operations is more felt in the Nigeria's business environment more than the Gambia's business environment. Though, the differential of the impact of AI-driven tools on efficiency of business between the countries could be associated with differences in policies and advancement in high technology adoption or implementation.

Recommendations

On the basis of the findings and conclusion reached, the following recommendations are made:

1. To enhance the increase in AI-driven technology adoption, the study recommends policy that will create more awareness on the benefits of incorporating AI tools to promoting efficiency of business operations among small and medium scale enterprises in the global economies especially the developing economies.
2. To boost more mobile subscriptions and reduce the negative impact of mobile subscription on the efficiency of business operations, the study recommends that government and other stakeholders in the information technology industry should come to agreement that will encourage more subscribers and at optimal costs.
3. The study strongly recommends the policy of public private partnership in the provision of infrastructural development most especially information technology to boost the application of AI-driven tools to boost efficiency of business operations in the developing economies of the Gambia and Nigeria.
4. To further entrenched and sustain the efficiency of business operations through the lens of foreign direct investment, it is recommended that more sustainable policy that will ensure continuous growth in the foreign direct investment most especially in the Gambia economy should be pursued with vigour.

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