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Research Article

Exploring the role of Artificial Intelligence Capabilities on Small and Medium sized Enterprises Growth in Nigeria

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Abstract

This study examined the relationship between Artificial Intelligence (AI), innovation, employment and growth of SMEs in Nigeria. Principal component analysis (PCA) and the structural equation model (SEM) were used to examine the role of AI on SMEs growth in Soutwest, Nigeria. The population of the study focused on SMEs firms engaging in manufacturing, hospitality, information and communication, and administrative and support services sectors. A sample size of 322 was adopted using Krejcie and Morgan method. Results of study showed that AI innovation indicators have positive relationship with SMEs growth. It was also observed that AI employment indicators exert a direct relationship with the latent factor. Overall results showed that applications of AI construct indicators remain (direct, indirect and total effect) strong on SMEs growth. Implications of the research results will offer a deeper insight for owners of SMEs, entrepreneurs, academic researchers and stakeholders to promote economic growth and development.

Keywords: Artificial intelligence. Employment. Innovation. SMSs. Information and communication.

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1. Introduction

Small and medium enterprises (SMEs) have been recognized as a channel of economic growth globally. SMEs play a key role in creating employment, adding value, and contributing to innovation to national economies around the world (OECD, 2017c). The World Bank report (2017) SME accounted for the mainstream of the global businesses and are significant to overall economic development. They account for about 90 percent of businesses and more than 50 percent of employment globally. Formal SMEs contribute up to 40 percent of national income (GDP) in emerging economies. These numbers are considerably higher when informal SMEs are added. However, these contributions differ among firms, industries, and countries, but inadequate physical and technology tend to have prevented them from functioning optimally and accessing global markets at competitive costs (Mazur, 2012, EaP Green, 2016, Ritu, Chand, & Amit, 2023).

Nigeria's modern day business environment is not only challenging but full of pitfalls that inhibit the full growth of SMEs (Anekwe, Ndubusi-Okolo, & Uzoezie, 2019; Bayode & Adebola, 2012). In a developing country like Nigeria, it requires continued growth in economies with special attention to the SMEs sector to harness employment generation, improved local technology and developed indigenous entrepreneurship. Regrettably, the SMEs in Nigeria have underachieved in spite of the fact that they constitute more than 90 percent of local businesses, but their impact to the nation's GDP is below 10 percent (see, Gbandi & Amissah, 2014; Ufual, Olujobi, Emielu, Ibidunni, Borisade, & Osabuohien, 2021).

However, the disruptive nature of the global pandemic on businesses has provided the need for digital transformation and ensuring the availability of AI solutions for SMEs growth to achieve long-term success (Travaly & Muvunyi, 2020; Ibidunni, Ufua, & Opute, 2021). It is alarming that despite the huge benefits of AI solutions technology, most Nigerian SMEs display attitudes that discourage its best practices and development (Ihesiene, & Akpojaro, 2015). Furthermore, it was speculated that many SMEs in Nigeria are either unwilling or slow at incorporating technology innovations and practices as shown by reduced rate of technology professional engagement, preference for contracting computer based non –professionals to drive technology role as well as infusion of technology units into other departments. This challenge highlights the focus of this study, which is on how to facilitate further integration of AI into the Nigerian SMEs sector.

The common fears are that AI portent threats to both highly-skilled service based (financial experts, legal work, medical care services) and low-skilled services (call agents in contact centres), with envisaging concern which may include unemployment and growing levels of disparity in future (Korinek & Stiglitz, 2017). The current AI literature has mirrored the nature of tradition form of unskilled and skilled employment (The World Bank,2019), is very essential to fathorn how innovation in technological advancement will impart

entrepreneurs creative, cognitive and processes when starting new venture (Obschonka & Audretsch, 2019, Townsend & Hunt, 2019).

This study holds the opinion that the evolving forms of robotics, together with some of the strategic responses intended to countervail the social-economic effects, that will likely shift some of the fundamentals on which the prevailing concepts and practical expectations concerning entrepreneurship repose (Chalmers, MacKenzie, & Carter, 2021). AI presently is creating new, high-paying careers that require skill acquisition and replacing low skill workers (Mamudu & Mustapha, 2017). There are inadequate portions of information accessible in the literature that validate proves that AI technology offers new prospects that can lead to a remarkable transformation in businesses and the general economic system (Klosters, 2016, Sang-Chul. 2017, Klaus, 2017, Freddi, 2018).

At the industry and business level the immense benefits of AI include speedy introduction of configurations in big data, quick conception and analytics, improved service / product development, delivery of painstaking insights, and a lot more. The benefits are designed and projected to introduce new levels of service or product, increased profit, growth of businesses, enhanced cost efficiency and cost (Cockburn *et al*, 2019). SMEs growth effect of AI are well-known by various scholars across the world (Chen, *el.al,* 2016). These studies have been conducted in advanced economy, the identified implications and results are relevant for the future growth of SMEs in Nigeria as well as that of Africa. Accenture conducted a study involving 12 countries, in the developed economy, they established that the application of AI system could create more than double the growth of the world economy by 2035 (Daugherty & Purdy, 2016, Prakash, Yadav, Singh, & Yadav, 2021).

This study aims at addressing the gap to gain by Nigeria SMEs in understanding the capability of artificial intelligence focusing on the following main objectives:

- examine the link between AI, innovation and growth of SMEs in Nigeria.
- determine impacts of Artificial Intelligence on employment and growth of SMEs in Nigeria.

The scope of the study covered SMEs in manufacturing, hospitality, information and communication, and administrative and support services sectors in the South West, Nigeria.

2 Literature review

Disruptive changes to business models today such as AI, advanced robotics, machine learning, and biotechnology will have a deep impact on the positioning of SMEs for efficiency and relevance over the coming years (PWC, 2020). Disruptive innovation are creating new lines of industries, business models, better ways of

doing things and destroying old ones. Artificial Intelligence (AI) capabilities simply means machine learning, digital systems, including related automation in service delivery or production (Ibidduni et al, 2021). These include robotics, block-chain, augmented and virtual reality, internet of things, 3D printing, autonomous vehicle, drones among others. AI advancement has gone through three stages: a journey toward machine learning in the 1990s and early 2000s; a growth in the acceptance of neural networks in the early 2010s with full automation of speech recognition processing of data, images and the current development in strengthening learning in the past decade (Hao, 2019, Kumar, & Shukla, 2022).

The concept of AI technology includes advance technology solutions that can address situation of uncertainty known as machine intelligence, is an intelligence validated by machines, in disparity to the natural intelligence shown by humans (Žigiene, Rybakovas, & Alzbutas, 2019). AI enables a machine to think like humans and has developed to be very known in today's business environment. It is the stimulation of normal intelligence in machines that are programmed to learn and imitate the actions man. These machines are able to acquire with experience and execute human-like tasks with accuracy and efficiency (Kitsios, & Kamariotou, 2021).

The AI applications are now being deployed in private and public sectors globally. Many countries are already addressing the issues and leveraging on the benefits from this evolving technology. Whereas, there is no generally established definition of Artificial Intelligence, Nilsson (2010) stated that AI is that set of activities dedicated to making machine intelligent and intelligence is that process that enables an entity to function optimally and with foresight in its environment. Today machine understand human speech, driving cars, competing in strategic game system, or interpreting complex data that are currently considered to be AI applications.

Many Africa governments have started to take deliberate actions to endorse the development of AI in their respective country. For instance, the Nigeria government has started to support and engage partnerships and stakeholder on the road map to AI development. The Minister in charge of Science and Technology pronounced the creation of the National Agency for Research in Robotics and AI.

The centre partners with international research bodies and improve training on Artificial Intelligence (AI) themes for students and schools, also to stimulate Nigeria's capability to ride on these technologies for economic development (Access Partnership, 2019; Gwagwa, Kraemer-Mbula, Rizk, Rutenberg, & de Beer, 2020). In March 2018, Adebayo Shittu, former Minister of Communications reaffirmed the government position to support artificial intelligence stakeholders. In the same vein in October 24, 2020 during the first edition of Digital Nigeria Day (DND) held by the Federal Ministry of Communications and Digital Economy at the NCC's Communications and Digital Economy Complex, Mbora, Abuja Nigeria (NCC, 2020; UNESCO 2019).

2.1 Artificial Intelligence Innovation for SMEs

In a world in which just-in-time delivery is the standard, AI innovation will be a game changer for SMEs competitiveness. Innovation comprise the change of new knowledge into new products or service and putting the new product or service into use, either at market or by other means of delivery (Trott, 3005). AI allows SMEs to be innovative, attain scale without mass and access global markets and knowledge networks at relatively low cost (OECD, 2015b). The digital evolution facilitates new opportunities for SMEs growth and enable them to compete in local and global markets, through service or product innovation and improved process delivery. It also facilitates the emergence of lean start-ups that leverage on internet at lower fixed costs and outsources of many segment of the business to stay agile and response to the market timely (OECD, 2018e; Ufua, Olujobi,Tahir, Okafor, Imhonopi, & Osabuohien, 2022).

In an era of AI, SMEs can turn their business into a competitive advantage by being innovative, creative and foster alliances with firms by providing real-time solutions to problems in every sector (Edmund, Christopher, & Zeman, 2020). SMEs are amenable, flexible, and fast adapting to changes towards efficiency (Sen, Doruk, Melike Ozturk, &Ozalp Vayvay. 2016). Before the introduction of machine learning, the transfer of knowledge-intensive tasks and functions in the business process to computer systems was limited to explicit knowledge (Edmund, *et al*, 2020). AI now enables SMEs to go further than their present state of knowledge base and able to advance more creative innovative solutions and recognise more opportunities in the global market (Amabile, 2019; von Krogh, 2018). With rapid technological development and the replacement of human organisation, AI reshapes and compel SMEs to rethink the company's processes through innovations. (Haefner et al, 2021). The central premise is that AI can deliver better quality, higher speed, more efficiency, and outstanding outcomes than human experts (Agrawal, *el.at*. 2018a).

McKinsey (2018) predicts a potential contribution of 1.2 percentage points to global GDP growth by 2030, while Purdy and Daugherty (2017) study forecasts an increase of 2 percentage points in annual global gross value added by the year 2035. These contextual call for a robust model where innovative oriented AI and machine learning of management information system and processes can be integrated into innovation management for SMEs development in Nigeria. With AI advancement, it is revealed that the innovation management and machine learning role will change and step up progressively. The human management is anticipated to function side by side with the AI and machine learning algorithms in in cartigorising and choosing opportunities as well examining what could be the organisation's competitive advantage in the global market (Haefner et al, 2021).

2.2 Artificial Intelligence Employment Creation for SMEs

In the entire human race today no part of the world is left from the impact of technology, either it is AI or internet of things (IoT), in every area of life humans have been dependent on machine (Sahil & Anupam 2019).

Whereas some jobs will be jettisoned additional jobs will be transformed that will need changed sets of skill. Others may require completely creating new jobs. Various careers and profession will continue to demand distinctive skills that AI and technology cannot reproduce such as creativity, complex communication, partnership, system thinking and talent to work in complex environment (see, Ufua, Salau, Saleem, Ogbari, Osibanjo, Osabuohien, & Adeniji, 2022).

Introduction of new technology has always been attended by caveats about job loss syndrome. However, in many situations new technologies have been lots of more specific, significant and skillful jobs as reported (Microsoft, 2018). Tomorrow work and workforce will depend on the sense of balance between technology and labour – allowing flexible allocation of resources on task that requires routine recurrence. The effect of technology on labour will depends on how the shift and efficiency affect each other (Accemoglu & Restrepo, 2019, Ibrahim, & Sarolta, 2022).

EY study in 2017 found out that in the next decade the skill of personnel that will be employed in the in the new jobs do not exist today. These jobs of the future will be altered and will requires fundamentally changed skillsets. Repetitive tasks will gradually be performed with the support process driven by AI, that is, work force will be more productive (EY, 2017). This infers continues change but also a tireless need for human labour, even in very automated backgrounds. Machine replacement for labour increases efficiency, productivity, quality delivery and minimizes the cost of goods and services. Although not always the case, and not forever have the influence of increasing employment in these same sectors (Bessen, 2017b; McKinsey Global Institute, 2017). Accenture (2017) in their recent report identified completely new sets of careers that are evolving in businesses engaging AI as part of their process. These professions consist of trainers and mentors (facilitate the AI systems), explainers and translators (explain and communicate the result of AI system to customers, and sustainers (monitor the performance of AI system, including following the fundamentals and ethical standards). (Olujobi, Yebisi 2022).

AI in Nigeria would create jobs and expand job growth (Victor, 2019). According to Adewoye (2019), there exist diverse schools of thoughts surrounding AI deployment in the work force. While some of school of thoughts believe that AI will not necessarily generate unemployment but will cause a major shift in the ways and dynamics of the work force operations in future, others believes that AI will adversely affect the nature of jobs that will be accessible to the work force, as it might result in the workplace existence, especially persons who the essential skills to relate with the operating system and the use of the internet. Nigeria and Africa's artificial intelligence can largely improve making decisions by breaking down huge amounts of a dataset which can give rise to the discovery of new products, services, market, and industry by the improving consumer interest that will spawn additional income flow in Africa (Obi, 2020).

2.3 Small and Medium-Sized Enterprises (SMEs) Development in Nigeria

Globally there is no clear definition of SMEs. However, according to the European Commission's, SMEs are firms that have less than 250 employees or that generate up to 50 million euros in annual turnover (EC 2017a). In Nigerian SMEs are business owners or entrepreneurs with capacity of workers ranges between 10 to 199 employees, who are involved in day to day businesses with the sole aim of their personal desire and profit (Abdul, 2019, SMEDAN, 2013). In Nigeria, according to Agwu and Emeti, 2014, SMEs are widely accepted as keys to economic prosperity and sustainability. Both SMEs and entrepreneurship are recognised worldwide as the mainstay of any economy (Okyere,2017). SMEs are entreprenuers who are very insightful to their immediate environment to see opportunities and turn around threats to make a difference toward economic and social benefits (Rey-Marti, Ribeiro-Soriano, & Sanchez-Garcia, 2016; Miller & Le Breton-Miller, 2017).
The report of the Nigerian Bureau of Statistics stated that SMEs in Nigeria accounted for a total of 17.4 million, about 48.5 percent of the national GDP in the last 5 years (PwC,2020). The same report also stated that about 50 percent of the industrial jobs and nearly 90 percent of the manufacturing sector in terms of the number of enterprises (PwC,2020).

The necessity of entrepreneurship in reducing poverty, employment creation and development of the economy is universal (Adeosun & Shittu, 2021). The Nigerian government, SMEs encounter enormous challenges ranging from inconsistency in government policies, harassment and extortion by the uniformed officers, lack of support from some government agencies that were supposed to assist (Tejumade, 2015; Ufua, Olujobi, Tahir, Al-Faryan, Matthew, & Osabuohien, 2022). According to Akerejola, Okpara, Ohikhena, and Emenike (2019), in spite of the repeated and supports by the Nigeria government to SMEs, they still encounter several challenges described as the Nigeria factors. Others problems include absence of a workable policy structure and inadequate infrastructure to drive SMEs creation and growth strategies in Nigeria (Victor, Christopher, & Ignatius,2019)

2.4 Small and Medium Scale Enterprise Growth

Nigerians essential need employment opportunities to make a living. SME is relevance in this regards in creating employment, production of goods and services in a fast growing economy (Adeosun & Shittu, 2021). Nwugballa, Elom, and Onyeizugbe, (2016) reported that SMEs contribute up to 75 percent total employment level in Nigeria. In the vein, according to Ajibola (2020), SMEs contribute to economic development and generate about 80 percent of jobs in Nigeria. In developing countries over 50 percent of jobs are created by SMEs, they also dominate the private sector in the same economies (Lorenz & Pommet, 2018). Although

significant growth has been recorded in the SMEs space, much is still required to be done, which justifies the intention of this study, focused on AI and SMEs growth in Nigeria.

3. Theoretical Framework on Small and Medium Sized Enterprises Growth

The underpinning theory for this study is the Peter Drucker propounded opportunity–based theory. Stevenson (1990) expanded the theory by building in creativity and resourcefulness into the theory. Stevenson established that SMEs seek to take advantage of every opportunity without taking care of currently resources within the control of the entrepreneur. The theory state that SMEs do not cause change deliberately rather they take advantage of the opportunities created because of technology changes. Drucker (1985), defines entrepreneur as an individual who seek for change, reacts to the change and thrive to exploits the opportunities. The theory of Opportunity-based entrepreneurship is connected to creative accomplishment that have the impact to generate employment and enhance productivities in any economy (Stenholm, Acts, & Wuebker, 2013). An entrepreneur starts with opportunities available in the environment. These opportunities are new concepts that variety of goods, services, raw materials and organizing stages can be presented and executed in a market place (Casson, 1982, Share & Venkatarantan, 2000). Opportunity-based entrepreneurs commence a business with quest for growth, innovation, profit and personal desires (Cullen, Parbotech, &Johnson, 2014, McMullen, Palich, & Bagby, 2008, Renuka & Anju, 2023), Sara, Dejan, Amadeja, & Anja, 2024)

3.1 Empirical Review of AI Capabilities on SMEs Growth

The policy drivers and SMEs in Nigeria, have recognised the significance of AI. The changes in AI innovation on the SMEs growth in the Nigeria space showed that the relationship between AI innovation (product and process) and SMEs growth in terms of firms' turnover is significantly high (Akinwale, Adepoju & Olomu, 2017). Against this background, the study examined previous work on the use of AI by SMEs. In their study Haefner, Wincent, Parida, and Gassmann, (2021), found out that AI and innovation management had helped SMEs firms having challenges with data processing restraints as they seek for new opportunities. For instance, where the growth of new innovations is primarily hindered by information management processing constraints, AI had resolved the concern effortlessly. AI acquisition and SMEs performance showed that the level of innovation and export longevity positively and substantially affect sales out of firms (Edmund, Christopher, & Zeman, 2020).

In Ogun state, Nigeria, the use of AI by small and medium enterprises revealed that demographic variable such staff capability and knowledge significantly influences its uses among SMEs (Oyebiyi, 2019). In their findings (Chalmers, MacKenzie & Carter, 2021) AI and SMEs growth in the Fourth Industrial Revolution 4.0 enhances entrepreneurial obligations, accomplishment that has its root from technological influence. On the

employment space of AI on SMEs, PwC department of business, energy and industrial strategy (BEIS) report showed that the United Kingdom's employment and the demand for skills recommend that AI and its allied technologies is very key in productive and real income levels, advancing UK GDP by up to 10 percent by 2030. Whereas in China, effects of AI on employment in the short-run is more destructive, however, in the long-run it create new employment opportunities (Ping & Ying, 2018)

The focus today is to investigate the progressive phases of the technological advancement a aggressively rather than having a flaccid approach toward it. In their study the Royal Society and the British Academy 2018, provided evidences that AI have meaningfully impacted over and above the function of trade libralisation. It further indicated that AI in the work place is related with increasing polirisation of work between tasks mostly executed by workers with low level of formal education and task performed by highly educated employees. Overall employment has not declined, however, there have been changes from manufacturing to service industry across geographical areas, and loss of income for low educated workers. Individual losses from job displacement connected to automation have not yet be appraised but a wider literature suggested that these losses can be significant.

Developing countries such as Nigeria are generally not included in the empirical analyses. However, the available studies in emerging economies reveal significant effect by AI and that the labour-saving impact of these new technologies might be even more pronounced than in the developed economies. Nonetheless, Nigeria SMEs have what it takes to stimulate development and growth by utilising the AI to enrich the nation's economy and her citizens.

4 Methodology

The study focused on SMEs growth in South West, Nigeria. Data were collected from SMEs firms to determine AI innovation and employment on SMEs growth. The questionnaire was adapted. The population of the study consist of 2,000 SMEs firms engaging in manufacturing, hospitality, information and communication, and administrative and support services sectors. The choice of South West, Nigeria is because it has the highest number of SMEs in Nigeria, the National Bureau of Statistics (2017).

The sample size of 322 is obtained from Krejcie & Morgan research table (1970) of a population size of 2,000. This number is considered a fair representation of the entire population (Saunders, Lewis &Thornhill, 2011). A response rate of 282 were received accounting for 88% questionnaire retrieved, of the selected SMEs firms in South West, Nigeria. Data were collected through the distribution of structured questionnaire administered.

The study applied principal component analysis (PCA) and the structural equation model (SEM) to examine the role of artificial intelligence on SMEs growth in South West, Nigeria. In the study PCA was

employed as a data reduction approach in measuring the items that significantly explain the latent construct indicators. Also, employed in this study is the variance extract from the commonalities analysis (Table 2) which serve to provide us with the loading scores of the items measured. Items loaded above average is considered relevant in the construct measurement. The validity and reliability of the process was established through the Kaise-Meye Oklin sampling adequacy (KMO) statistics and the Bartlett's Test for structure detection (Table1). Based on the Chi-square normality distribution and BTS high level of significance, the factors indicators with their respective loaded items were considered valid and credible for conducting this research (Rana & Singahi, 2015).

The second aspect of the data analysis involved the application of the SEM technique for the measurement and structural model analysis. In the measurement model the construct indicators were analyzed based on the data reduction result from the principal component outcome (Figure1). The variance-covariance result was examined through the measurement model and the test for multi-collinearity. This helps us to verify the no-existence of significance interferences among the construct's indicators involved in the SMEs growth model analysis. Path analysis (Figure2) was further utilized to determine the direction, magnitude and significant of the relations among artificial intelligence AI. In this process, the estimates, standard error (S.E), coefficient ratio (C.R), significance level (P) and the regression weights (Label) in line with the structural model were employed (Table3).

5 Results and discussion

The analysis of the impact of AI on SMEs growth was carried out using principal factor analysis and structural equation model (SEM) approach. The factor analysis focuses on the principal factor analysis (PCA) while the SEM involved the measurement model and the structural path.

Table 1: Validity and Reliability Tests

	Sampling Adequacy measure		Bartlett's Test of Sphericity	
Factors	KMO	Approx. Chi-Square	DF	P-value
AI Adoption	0.783	460.891	10	0.000
AI Innovation	0.846	474.815	10	0.000
AI Employment	0.592	246.243	10	0.000
SME Growth	0.596	132.190	10	0.000

In Table 1, The Kaiser-Meyer-Olklin statistic measure of sampling adequacy (KMO; 0.783; 0.846; 0.592 &0.596) and Bartlett's test of sphericity (BTS:460.891, P-value<0.01; 474.815, P-value<0.01; 246.243, P-

value<0.01 & 132.190, P-value<0.01) were utilized in testing for the proportion of variance in the variables that could be as a result of underlying factors. The results respectively attest to the suitability of the factors- AI-adoption, AI innovation, AI employment and SME growth for structure detection. The validity and reliability results show that the exists significant proportion of variance in the AI and SME factors that could be attributed to latent factors. The reliability test shows the items are consistent and suitable for structure detection analysis.

5.1 Principal Component Analysis

In the analytical process of this study, 3 factors were used to measure artificial intelligence (AI) comprising of AI adoption (AI_ADP), AI innovation (AI_INN) and AI employment growth (AI_EMPG) and SME growth (SMEG) as the higher order factor. The principal component analysis (PCA) was employed in the data reduction approach to ascertain the items that constitute significance variance explained in measuring artificial intelligence (AI) and SME growth factors.

Five items were used in measuring AI adoption which consist of service operations (SEOP) predictive service intervention (PSIN), customer service analytics (CSEA), new AI-based enhancement of products and services, (NAI_BEPS) and fraud and debts analysis (FRDS). The result from the variance extracts (SEOP, 0.590); (PSIN, 0.765); (CSEA, 0.680); (NA_BEPS, 0.526) and (FRDA; 0.231) shows that all the items measuring AI adoption loaded above average score with the exception of FRDA.

Table 2: Items Loadings

AI ADOPTION	**Variance Extraction**
SEOP	0.590
PSIN	0.765
CSEA	0.680
NAI_BEPS	0.526
FRDA	0.231
AI INNOVATION	
PRCIN	0.731
PSEIN	0.832
INFTEC	0.746
INFRDEV	0.796
COLWO	0.770
AI-EMPLOYMENT	
DEFNS	0.717

JCEF	0.788
JDEF	0.823
NEMEF	0.579
FSDS	0.331
SME GROWTH	
CSAVS	0.613
INREV	0.591
DEREV	0.635
PRSRS	0.676
RRASC	0.468

AI innovation was measured with five items comprising of process innovation (PRCIN), product or service innovation (PSEIN), information technology (INFTECH), infrastructural development (INFRDEV) and collaboration with others (COLWO). The analysis of the item loadings for the factor (PRCIN,0.731; PSEIN, 0.832; INFTEC, 0.746; INFRDEV, 0.796 and COLWO, 0.770) indicates that all the item measures of AI innovation were well loaded above average.

AI employment was measured with items consisting of demand for new skills (DEFNS), job creation effect (JCEF), job displacement effect (JDEF), net employment effect (NEMEF) and future skills demand (FSDS) while the factor items for SME growth comprises of cost of savings (CSAVS), increase in revenue (INREV), decrease in revenue (DEREV), prospects remain strong (PRSRS) and the items that measured that risks remain an area of significant concern (RRASC). Evidence from the variance extract (DEFNS, 0.717; JCEF, 0.788; JDEF, 0.823; NEMEF, 0.579 and FSDS, 0.331) shows a high variance explained by the individual items beyond 50 percent average except for FSDS. This evidence shows that majority of the measured items predominantly explained AI employment.

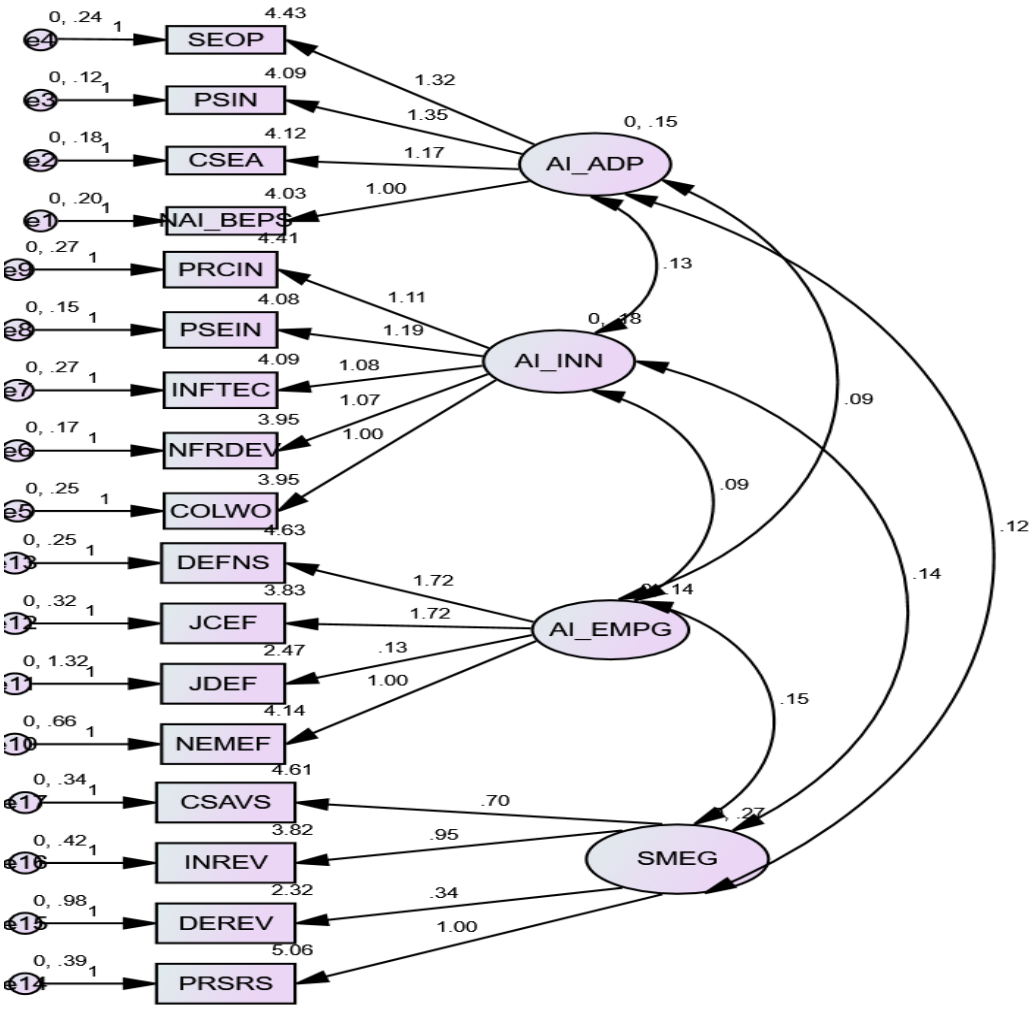
SME growth is measured using cost savings (CSAVS), increase in revenue (INREV), decrease in revenue (DEREV), prospects remain strong (PRSRS) and risk remains an area of significant concern (RRASC). The analysis of the item loadings (CSAVS, 0.613; INREV, 0.591; DEREV, 0.635; PSSRS, 0.676 and RRASC, 0.468) shows a relatively high loaded items above average except for RRASC. Notably all items variance of 0.50 and above (Table1) in this study were employed in further analysis in structural equation modelling in the structural model and measurement with exclusion of items whose loaded weights fail below average.

The study applied the structural equation modeling (SEM) approach involving the measurement model (Figure 1) in its to factor analysis. Having identified the loading scores, the items with extraction scores above 50 percent average were utilized in latent factor measurement model of SEM. As shown in figure 1, AI- adoption,

AI employment and SME growth were measured with four items while AI innovation was measured with five items all loaded above average.

5.2 Covariance Analysis

In the measurement model (Figure1), it is observed that all the factors measured were not significantly



correlated among themselves. Hence, there is no problem of multicollinearity among all the factors considered in this study. The covariance scores (Cov) between AI adoption and the following factors; AI_INN (Cov =0.13); AI_EMPG (Cov =0.09); and SMEG (Cov =0.12) were not significant. Likewise, there is no significant covariance between AI_INN and the following AI_EMPG (Cov =0.09); SMEG (Cov =0.14) and between AI_EMPG and SMEG (Cov =0.15). This shows the factor measures were all independent and uncorrelated in the SEM measurement model. The rule of thumb for the decision rule is explained by the construct correlation coefficients less than 0.50-point estimate.

Figure 1: Measurement Model

Regression Weights of Factor Indicators

In the AI adoption factor analysis, AI based enhanced products and services was the referenced item. The result of the regression weights (W) shows that service operations (SEOP) predictive service intervention (PSIN), customer service analytics (CSEA), new artificial intelligence-based enhancement of products and services, (NAI_BEPS) all exerted positive and more than a unit effect on AI adoption. The result of regression scores between AI adoption and its measurement items indicates a positive relationship for all the indicators. It is seen that CSEA, PSIN and SEOP respectively improved AI-adoption by 1.17, 1.35 and 1.32 times compared to NAI_BEPS. This implies that all the item measures AI adoption were all positively related with the factor while predictive service intervention accounted for the highest influence on AI adoption in SME growth.

In the case of AI innovation, the reference category refers to the item in the research instrument measuring collaborations with others. The estimated regression weights show that INFRDEV, INFTEC, PSEIN and PRCIN individually enhanced AI innovation by 1.07, 1.08, 1.19 and 1.11 times in relation to COLWO. It is also notable that all the AI innovation indicators suggests a positive relationship with the construct. A detailed analysis of the indicator's regression weights shows the product and service innovative indicator as the most substantive aspect of AI_INN that enhances small and medium scale enterprise growth.

Using net employment effect (NEMEF) for the reference category in the construct measurement for AI employment growth, it observed that all the construct indicators exert a direct relationship with the latent factor. Specifically, JDEF, JCEF and DEFNS promoted AI_EMPG by 0.13, 1.72 and 1.72 times compared with NEMEF. The demand for new skills in labour market and job creation effect of AI utilization accounted for the most notable enhancement in AI employment.

In the measurement of SME growth, the item measure for prospects of AI promotion of SME growth remaining strong (PRSRS) was the referenced variable. The evidence from the regression weights indicates less proportionate influence on SME growth. The deeper interpretation of the results shows that DEREV, INREV and CSAVS increased SMEG by 0.34, 0.95 and 0.70 times given the fact that there are prospects for AI induced SME growth in the future. Thus, the indicator for increased revenue measurement suffices as the most dominant influencer of SMEs enter growth traceable to AI employment factor in the present study model.

Figure 2: Structural Model

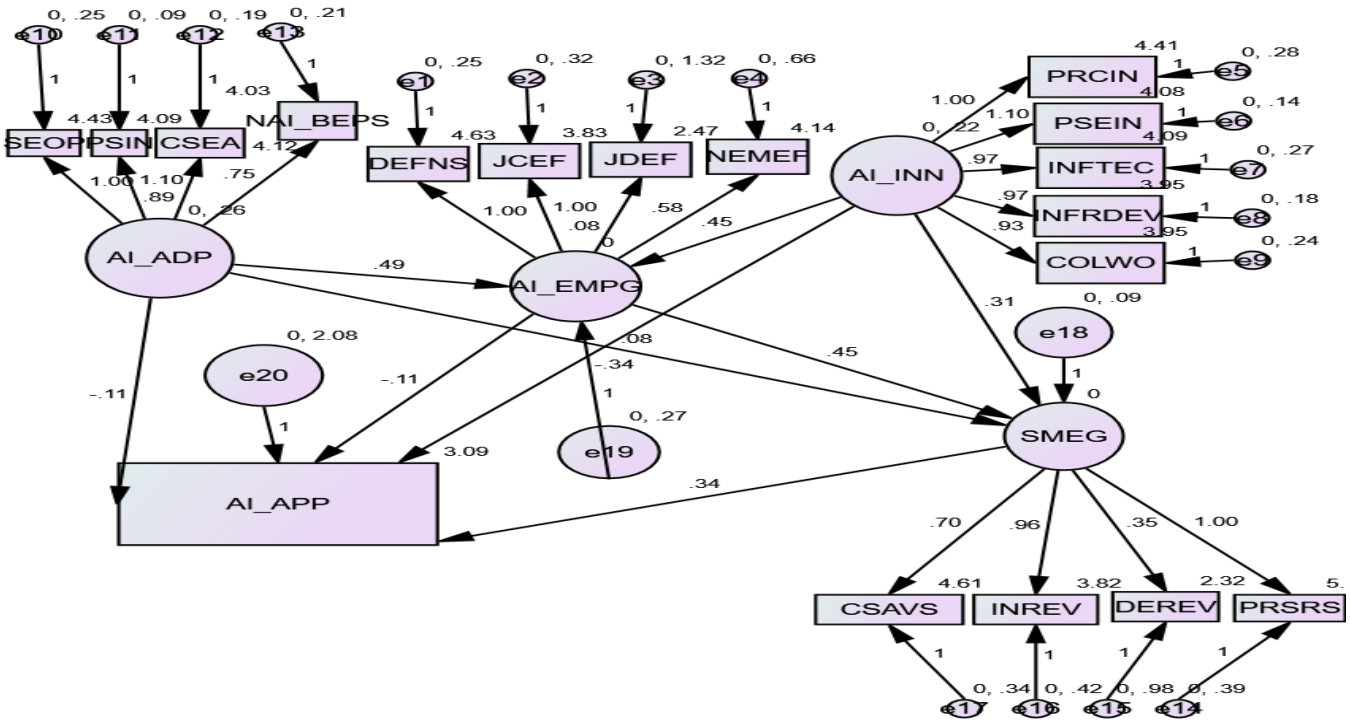


Figure 2 shows the structural part of the SEM model that examined the transmission channels through AI construct measures influence of SMEs growth employing both the direct, indirect and total effect model in analytical procedure. Having considered the measurement model, the study proceeds to examine the diverse roles of AI construct indicators on SME growth through regression analysis involving interaction model effect.

Direct Effects

In the analysis of the artificial intelligence and SME growth (Table3), it is seen that AI_ADP regression weight (W= 0.489; P-value <0.01) and AI_INN (W = 0.453; P-value <0.01) exerted a direct influence on AI_EMPG and an indirect influence on SMEG through AI_EMPG. The regression weights for AI_INN (W=0.311: P-value <0.01); AI_EMPG (0.453: P-value <0.01) and AI_ADP (0.075: P-value >0.1) on SMEG shows that AI innovation and employment significantly improved SME growth while the reverse is the case for AI adoption.

5.2.4 Table 3: Direct Effects of AI on SME growth

Constructs and indicators			Estimate	S.E.	C.R.	P	Label
AI_EMPG	<---	AI_INN	.453	.098	4.625	***	W14
AI_EMPG	<---	AI_ADP	.489	.091	5.380	***	W17
SMEG	<---	AI_INN	.311	.090	3.449	***	W15
SMEG	<---	AI_EMPG	.453	.092	4.936	***	W16
SMEG	<---	AI_ADP	.075	.080	.937	.349	W22
Demand_ for_ new_ skills	<---	AI_EMPG	1.000				
Job_ creation_ effect	<---	AI_EMPG	.997	.109	9.116	***	W1
Job_ displacement_ effect	<---	AI_EMPG	.078	.129	.603	.546	W2
Net_ employment_ effect	<---	AI_EMPG	.583	.101	5.759	***	W3
Process_ innovation	<---	AI_INN	1.000				
Product_ or_ service_ Innovation	<---	AI_INN	1.098	.102	10.760	***	W4
Information_ Technology	<---	AI_INN	.974	.106	9.222	***	W5
Infrastructural_ development	<---	AI_INN	.969	.096	10.095	***	W6
Collaboration _with_ others	<---	AI_INN	.930	.100	9.342	***	W7
Service_ operations	<---	AI_ADP	1.000				
Predictive_ service_ intervention	<---	AI_ADP	1.097	.090	12.125	***	W8
Customer_ service_ analytics	<---	AI_ADP	.891	.082	10.856	***	W9
AI_ Enhanced_ product_ service	<---	AI_ADP	.751	.078	9.649	***	W10
Prospects_ remain_ strong	<---	SMEG	1.000				
Decrease_ in_ revenue	<---	SMEG	.349	.155	2.257	.024	W11
Increase_ in_ revenue	<---	SMEG	.960	.147	6.513	***	W12
Cost_ savings	<---	SMEG	.700	.117	5.962	***	W13
AI_ Applications	<---	AI_ADP	-.113	.218	-.520	.603	W18
AI_ Applications	<---	AI_EMPG	-.108	.335	-.324	.746	W19
AI_ Applications	<---	AI_INN	-.337	.276	-1.221	.222	W20
AI_ Applications	<---	SMEG	.335	.509	.659	.510	W21

Although AI adoption (W= -0.113; P-value>0.05), employment (W= -0.108: P-value >0.05) and innovation (W= -0.337; P-value >0.5) is inversely related to AI usage they are not statistically significant while SME

growth (W=0.335; P-value>0.05) is supportive of AI usage but not significant. Hence, it is observed that SME growth factor accounted for the positive relationship with AI applications. Notably, it is seen that though AI innovation and adoption enhances AI employment growth, these indicators have not enhanced the effective utilization of AI applications is apparently not significant and retarded in SME business activities. This further points to the high cost involved in the procurement and maintenance of AI- enabled applications particularly in the area of small and medium scale operations.

In the construct analysis of AI-EMPG, DEFNS represented the referenced variable while JCEF (W=0.997; P-value <0.01) regression weight was positively strong and significant. The results for JDEF (W=0.078: P-value >0.1) and NEMEF (W=0.583: P-value<0.01) shows that both indicators accounted for 0.08 and 0.58 times increase in AI employment compared to the demands for new skills though job displacement effect was insignificant. This implies that AI induced job creation and net employment effect explained the highest variation in AI employment thus confirming the earlier result from the measurement model.

For the AI innovation, the analysis of regression weights associated with PSEIN (1.098; P-value <0.01), INFTEC (0.974; P-value <0.01), INFRDEV (0.969; P-value <0.01) and COLWO (0.930; P-value<0.01) indicates that these indicators respectively increased AI innovation by 1.10, 0.97, 0.97, and 0.93 times relative to process innovation. It also informative of the fact that product and service innovation had the highest contributory effect from the list of AI innovative indicators that have influenced the promotion of SME growth culminating to improved usage of AI applications for economic growth and development. The indicators are statistically significant and positively contributed AI innovation at 1 percent level.

In the structural model, the analysis of AI adoption indicators with the referenced category (SEOP) indicates that PSIN (1.097; P-value <0.01), CSEA (0.891; P-value <0.01), and NAI_BEPS (0.751; P-value <0.01), significantly increased AI adoption by 1.097, 0.891 and 0.751 times in relation to SEOP with predictive service intervention accounting for the highest contribution to AI adoption in SME growth. In terms of SME growth, the estimated coefficient of DEREV (W=0.349; P-value<0.05), INREV (W=0.960: P-value <0.01) and CSAVS (W=0.700; P-value <0.01) with PRSRS as the referenced item suggests that cost of savings, increase revenue and decrease revenue significantly increased SMEG growth by 0.70, 0.96 and 0.35 times in relation to the fact that prospects remain strong for SME growth.

AI adoption (W= -0.113; P-value>0.05), employment (W= -0.108: P-value >0.05) and innovation (W= -0.337; P-value >0.05)

is inversely related to AI usage they are not statistically significant while SME growth (W=0.335; P-value>0.05) is supportive of AI usage but not significant. Hence, it is observed that SME growth factor accounted for the positive relationship with AI applications. Notably, it is seen that though AI innovation and adoption enhances AI employment growth, these indicators have not enhanced the effective utilization of AI

applications is apparently not significant and retarded in SME business activities. This further points to the high cost involved in the procurement and maintenance of AI- enabled applications particularly around small and medium scale operations.

Indirect Effects

The analysis of the indirect effect of AI_INN (0.205) and AI_ADP (0.221) on SMEG (Table4) shows a mediation effect on SMEG through the AI_EMPG channel in line with the Druncker (1985) and Stevenson (1990) opportunity-based theory which also informed the theoretical base of the present study discussed in the previous section of this work.

Table 4: Indirect Effects

Construct and indicators	AI_INN	AI_ADP	AI_EMPG	SMEG
AI_EMPG	0.000	0.000	0.000	0.000
SMEG	.205	.221	0.000	0.000
AI_Applications	.124	.046	.152	0.000
Cost_savings	.362	.208	.317	0.000
Increase_in_revenue	.496	.285	.435	0.000
Decrease_in_revenue	.181	.104	.158	0.000
Prospects_remain_strong	.517	.296	.453	0.000

In its present contextualization and operationalization, the entrepreneur maximizes the opportunities and changes induced by AI innovation and adoption to harness AI employment in a bid to increase economic activities that will foster significant growth within the small and medium enterprises' framework.

In Table4 it is also pertinent to note that AI_INN and AI_ADP indirectly enhanced SMEG by 0.205 and 0.221 percent. AI INN, AI ADP and AI_EMPG respectively improved AI usage by 0.124, 0.046 and 0.152 percent. These AI indicators indirectly accounted for the respective 0.362, 0.208 and 0.317 percent increases in cost savings. AI innovation, adoption and employment individually increased revenue by 0.496, 0.285 and 0.317 percent and also contributed for a 0.181, 0.104 and 0.158 percent decline in revenue.

This could be explained by high initial cost of AI procurement and installations which would consequently decrease revenue generation in the short-run, though increased revenue outweighs the perceived decrease. However, AI_INN, AI_ADP and AI_EMPG respectively increased prospects in SME growth by 0.517, 0.296 and 0.453 percent while AI employment growth constituted the mediated channel through SME growth was improved by the artificial intelligence indicators.

Total Effects

The total effect result (Table 5) shows the combined interaction effect (direct and indirect) of artificial intelligence indicators on SMEs growth through AI enabled employment growth opportunity. This further reaffirmed the existence of Druncker (1985) and Stevenson (1990) opportunity-based theory which in this context fortressed the AI induced growth opportunity that provides a veritably transmission channel for small and medium scale enterprise investors to maximize in order to grow their businesses as a veritable business risk adventure. The analysis of the total effect of AI_INN and AI_ADP shows a total increase of 0.453 and 0.489 percent on AI employment growth.

Deeper insight from the result shows that AI_INN and AI_ADP increased SMEs business growth by 0.517 and 0.296 from 0.453and 0.075 while AI_EMPG maintained a 0.453 percent increase in SMEs growth being the transmission channel of opportunity maximized by SMEs investors in driving their business growth and expansion through AI induced employment growth. However, with the exception of the retarded total effect in AI applications it is pertinent to portress the fact that direct, indirect and total effect of AI construct indicators remain the same for SMEs growth indicators given the fact that the mediated role of AI induced employment growth was estimated on the construct level.

Table 5: Total Effects

Construct and indicators	AI_INN	AI_ADP	AI_EMPG	SMEG
AI_EMPG	.453	.489	.000	.000
SMEG	.517	.296	.453	.000
AI_Applications	-.213	-.067	.043	.335
Cost_savings	.362	.208	.317	.700
Increase_in_revenue	.496	.285	.435	.960
Decrease_in_revenue	.181	.104	.158	.349
Prospects_remain_strong	.517	.296	.453	1.000

This same result also applies to the influence of the SME growth on its indicators involving cost of savings, increase in revenue, decrease in revenue and its sustainability of strong prospects in the future. (Olujobi, Olarinde, Yebisi, Okorie, 2022).

Table 6: Diagnostic Tests of Model Fit and Parsimony

Fitness Index	ECVI	RMSEA	NFI	CFI	NCP
Model	2.153	0.099; 90% CI	0.738	0.788	351.895
Cut-off values	1.927-2.406	0.09-0.1; 90% CI	0.370- 0.990	0.370- 0.990	288.593-422.771

Structural equation modelling refers to a comprehensive set of technique used to examine systems of equation often involving latent variables. In a situation where the mean structural of the model has no constraint the model parameter of the model could be analysed through the covariance structure approach. This involves minimizing a discrepancy function between the sample (observed) covariance matrix and the model implied (fitted) covariance matrix. In this study the discrepancy function is concerned with the normal distribution theory of the maximum likelihood (ML) discrepancy function. In the diagnostic test, the SEM result in this study was further tested for the 'significancy' of this discrepancy in relation to the baseline and hypothesized model. A notable unstandardized size effect of model misfit is the root mean square error of approximation (RMSEA; Browne & Cudek, 1992, 1993; Steiger, 1980, 1990, Maydeu-Olivares, 2017a). The RMSEA (0.099) indicates the rejection of the null hypothesis of model overall misfit.

The comparative fit index (CFI; 0.788) was utilized for the baseline comparison model test which shows that the implied model is statistically significant. The expected cross validation index (ECVI; 2.153) attests to the parsimony of the estimated model. The non-centrality parameter (NCP;351.895) indicates the result fall within the lower and upper bound test of acceptability. The parsimony of the model and the goodness of it measures and their respective cut-off values are presented in Table 6. According to the suggested benchmarks, all the fit indices accept the hypothesized model.

6. Conclusion and policy implications

In spite of the increasing concerns of implications of automation for the future of workspace, artificial intelligence AI is believed to have strong potential growth on SMEs. The results from the study clearly shown that a deliberate adoption of artificial intelligence by SMEs and entrepreneurs and their capability will be a game changer in future competitiveness. A deeper insight from the result showed that applications of AI construct indicators remain (direct, indirect and total effect) strong on SMEs growth. The understanding of sceptics regarding automation sometimes wrongly interpret that AI will steal jobs is not completely true. On the contrary that AI will eliminate number of some jobs and subsequently unemployment, the study showed

that more jobs will be altered that need diverse skill of personnel, as completely new jobs will be created as result of AI.

In addition, jobs will continue to necessitate outstanding human skills that AI cannot altered such as creativity, partnership, complex communication, skill to work in multifaceted environment. The initial assertions that SMEs in Nigeria are either unwilling or slow at integrating effective AI innovations and practices now shown from the concluding result of the study remain seasonable and robust. Policy implications among others is that regulatory institutions should build capacity to monitor and enforce the extant laws, regulations and policies to promote Artificial Intelligence utilization and capabilities building by SMEs to promote economic growth and development in Nigeria (Olujobi., et al 2022).

For further suggestions, besides encouraging SMEs on the application of AI to stimulate growth, there seems to be a need for the Government and educational institutions to develop skills set to stimulate AI adoption by SMEs. Digital training centres should be established to produce trainers and professional. The University curriculum should be reviewed and expanded to accommodate hands-on application of artificial intelligence.

Limitations and Future Research Directions

The study focused specifically on SMEs in the South West region of Nigeria and sectors such as manufacturing, hospitality, information and communication, and administrative and support services. The findings may not be easily applicable to SMEs in other regions or sectors within Nigeria or beyond. While the sample size of 322 is reasonable for the population size of 2000, the representativeness of the sample in terms of industry distribution and geographical coverage within the Southwest region could affect the acceptability the findings. Although SEM is used to analyse relationships, establishing causality between AI innovation, employment, and SMEs growth can be challenging. The study may need to address potential confounding variables or alternative explanations for the observed relationships.

As AI technologies evolve, exploring the adoption and impact of advanced techniques like machine learning, natural language processing, or robotics on SMEs could be another area of future research.
Exploring the ethical considerations and social impacts of AI adoption in SMEs, such as job displacement or changes in skill requirements, is crucial for sustainable development.

Addressing these limitations and exploring these future research directions, scholars can contribute to a more comprehensive understanding of how AI influences innovation, employment, and growth in SMEs, not only in Nigeria but also globally. This would provide valuable insights for policymakers, entrepreneurs, and stakeholders aiming to leverage AI for economic development and inclusive growth.

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