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Thank you.

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INTEGRATION OF AI TO ENTREPRENEURSHIP EDUCATION IN NIGERIA: STRATEGIES AND BARRIERS

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Abstract: The integration of Artificial Intelligence (AI) into entrepreneurship education has garnered significant attention due to its potential to foster innovation, drive economic growth, and equip future entrepreneurs with essential skills. This study aims to identify strategies for effective integration of AI into Nigerian entrepreneurship education while exploring potential barriers. Through a comprehensive literature analysis, key strategies such as leveraging technological entrepreneurship, curriculum development, capacity building, and supportive policies are highlighted. Concurrently, barriers including infrastructural challenges, limited AI expertise, curricular limitations, and societal perceptions are examined. The findings underscore the need for a multi-faceted approach involving policymakers, educators, and stakeholders to address these challenges and implement identified strategies. Recommendations encompass developing robust policies, investing in capacity building, revising curricula, fostering collaborations, and promoting AI adoption. By integrating AI into entrepreneurship education effectively, Nigeria can foster an AI-driven entrepreneurial ecosystem, driving economic renaissance and enhancing competitiveness in the global market. The study contributes to the discourse on harnessing AI for entrepreneurial development and provides a foundation for future research and policy initiatives in this domain.

Keywords: Artificial Intelligence, AI adoption, Entrepreneurship Education, Entrepreneurial Development

Introduction

In the rapidly evolving global landscape, where technological advancements are reshaping industries and economies, the integration of Artificial Intelligence (AI) into various sectors has become imperative for nations seeking to remain competitive and foster sustainable development (Makridakis, 2017). AI, with its capacity to process vast amounts of data, automate processes, and augment human intelligence, has the potential to revolutionise various aspects of entrepreneurship, from ideation and market analysis to operational efficiency and decision-making (Duan et al., 2019). Recognizing this potential, many countries have prioritised the integration of AI into their educational systems, particularly in entrepreneurship education programs, to equip aspiring entrepreneurs with the necessary skills and knowledge to navigate the AI-driven business landscape (Zahidi, 2020).

Nigeria, as one of Africa's largest economies and a rapidly growing entrepreneurial hub, faces the challenge of leveraging AI to drive economic development and foster a thriving entrepreneurial ecosystem (Odeyemi, 2023). Despite the country's vast human capital and entrepreneurial potential, the integration of AI into entrepreneurship education programs has been limited, hindering the development of AI-literate entrepreneurs capable of harnessing the technology's transformative power (Benson et al., 2023). The issue of insufficient comprehensive strategy for integrating AI into entrepreneurship education programs in Nigeria has resulted in a significant skills gap, hampering the country's ability to harness the full potential of AI for economic growth and

entrepreneurial success (Odeyemi, 2023). This gap not only limits the competitiveness of Nigerian entrepreneurs in the global market but also hinders their ability to harness the full potential of AI for driving economic growth and fostering sustainable entrepreneurial ventures (Purity & Ifeoma, 2018).

The primary objective of this study is to identify strategies for effective integration of AI into entrepreneurship education programs in Nigeria, while also exploring potential barriers that may impede this integration process. By addressing these objectives, the study seeks to contribute to the development of a robust and AI-driven entrepreneurial ecosystem in Nigeria, ultimately fostering economic growth and enhancing the country's competitiveness in the global market.

Literature Review

Conceptual Review

Artificial Intelligence (AI)

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, particularly computer systems (Russell & Norvig, 2020). AI involves the development of algorithms and systems that can perform tasks that typically require human intelligence, such as learning, problem-solving, reasoning, perception, and decision-making (Kaplan & Haenlein, 2019). AI technologies encompass various subfields, including machine learning, natural language processing, computer vision, robotics, and expert systems, among others.

Entrepreneurship Education in Nigeria

Current state, challenges, and opportunities Entrepreneurship Education has gained increasing recognition in Nigeria as a catalyst for economic growth, job creation, and sustainable development (Enu, 2012). However, the current state of Entrepreneurship Education in the country is characterised by several challenges, including outdated curricula, limited resources, and a lack of practical exposure (Ubogu, 2020). Despite these challenges, Entrepreneurship Education offers opportunities for fostering an entrepreneurial mind-set, equipping students with essential skills, and promoting innovation (Ogbari et al., 2016).

The Role of AI in Entrepreneurship and Economic Development

Artificial Intelligence (AI) has emerged as a game-changer in various sectors, including entrepreneurship and economic development. AI technologies can enhance market analysis, customer insights, operational efficiency, and decision-making processes for entrepreneurs (Naudé, 2020). Furthermore, AI has the potential to drive economic growth by optimising resource allocation, improving productivity, and fostering innovation (Agrawal et al., 2019). However, the successful integration of AI into entrepreneurship requires a skilled workforce equipped with the necessary knowledge and competencies (Chui et al., 2018).

Global Best Practices: Integrating AI into Entrepreneurship Education Programs

As the integration of Artificial Intelligence (AI) into entrepreneurship education gains momentum globally, several countries have pioneered innovative strategies and best practices in this domain. These successful strategies offer valuable insights and adapt effective practices to its local

context, fostering an AI-driven entrepreneurial ecosystem.

1. United States: The AI4K12 initiative, launched by leading technology companies and non-profit organisations, aims to introduce AI concepts and skills into K-12 education. This initiative provides resources, curricula, and professional development programs for educators to integrate AI into various subjects, including Entrepreneurship Education (Touretzky et al., 2019).

2. European Union: The OECD has developed guidelines for integrating AI into educational systems across EU member countries. These guidelines emphasize an interdisciplinary approach, ethical considerations, and the development of AI-related competencies. Several European countries such as Finland and Estonia have implemented AI-focused entrepreneurship programs and courses in their educational institutions (OECD, 2019).

3. Singapore: The Singapore government has launched various initiatives to promote AI in Entrepreneurship Education. Programs like the AI for Everyone (AI4E) and the AI Apprenticeship Programme (AIAP) aim to equip students and professionals with AI skills and knowledge. Additionally, the government has established partnerships with industry leaders and research institutions to foster AI-driven entrepreneurship (Toh & Kwan, 2021).

4. China: China has made significant investments in AI education and research, positioning itself as a global leader in this field. The country has implemented AI-focused curricula and specialised programs in universities, encouraging the development of AI-enabled entrepreneurial ventures and start-ups. Collaboration between academic institutions and industry partners is a key strategy for fostering AI entrepreneurship in China (Xu et al., 2022).

5. Canada: The Canadian government has launched initiatives like the Pan-Canadian Artificial Intelligence Strategy, which aims to advance AI research, talent development, and commercial adoption. Several Canadian universities have established entrepreneurship programs and incubators focused on AI, providing students with opportunities to develop and commercialise AI-based solutions (ISED Canada, 2022).

6. Israel: Israel's start-up ecosystem and entrepreneurial culture has been leveraged to integrate AI into Entrepreneurship Education. Programs like the AI Entrepreneurship Program at the Hebrew University of Jerusalem offer courses, mentorship, and networking opportunities for aspiring AI entrepreneurs. Additionally, partnerships with industry leaders and research centres facilitate knowledge transfer and real-world applications (Hebrew University, 2021).

These examples showcase various strategies adopted by different countries, including curriculum development, capacity building, industry collaborations, policy initiatives, and the establishment of specialised programs and incubators. By adapting and tailoring these best practices to the Nigerian context, stakeholders can develop effective strategies for integrating AI into Entrepreneurship Education programs in the country.

Theoretical Review

The Diffusion of Innovations Theory (Rogers, 2003) provides a useful framework for understanding the integration of AI into entrepreneurship education programs. This theory explains how new ideas or technologies spread through a social system over time through channels. It provides relevant foundations for the process of adopting innovation, innovation characteristics and contextual factors that facilitate or hinder adoption of innovation. In application to this study, AI represents the innovation while the potential adopters are entrepreneurship educators, institutions and students in the Nigerian higher education and training ecosystem.

The key elements of the theory, including innovation characteristics and attributes, communication channels, time, and the social system, can be applied to the adoption and diffusion of AI in Entrepreneurship Education. By understanding the factors that influence the adoption and diffusion of AI, stakeholders can develop effective strategies to overcome barriers and facilitate the successful integration of AI into entrepreneurship education programs

Rogers (2003) identified five (5) stages which include knowledge, persuasion, decision, implementation and confirmation. These stages can be examined in the context of this study to clarify the sequence of adoption and factors affecting adopters' decisions. At the Knowledge Stage, students and educators become aware of AI and its relevance. This includes considerations for IT infrastructure, institutional capacity and development opportunities for educators. The second stage, Persuasion is where people form attitudes towards AI. Here, the usefulness, relevance to curriculum and compatibility with pedagogical practices are evaluated. In evaluation, some of the pros which would encourage acceptance will be improvement in efficiency and entrepreneurial creativity while cons which would discourage embracement of AI include perceived complexity and being replaced.

At the Decision Stage, adopters commit to either acceptance or rejection. Institutions with strong innovation culture with positive factors such as leadership support, institutional policies and funding commitment are more likely to adopt AI. The Implementation Stage is concerned with the actual usage of AI such as its incorporation in idea generation, market analysis, assessment, etc. at this stage, barriers to adoption become evident e.g. infrastructure challenges, low digital literacy, etc. The final stage, confirmation stage is where adopters seek reinforcement for decision. If the adoption in the implementation stage yields positive outcomes such as improved teaching effectiveness and student capacity, then this would encourage sustained use. In the same vein,

challenges during adoption such as lack of infrastructure and technical failures can discourage continuance.

This theory is also relevant to this study from the perspective of the five (5) key attributes of innovation which are relative advantage, compatibility, complexity, trialability and oservability. Specifically for understanding the integration of AI into entrepreneurship education in Nigeria, this theory of Rogers (2003) is examined as follows. The perceived benefits (relative advantage) of adoption over traditional methods must be visible to educators and student. AI technology must be seen to be aligned (i.e. compatible) with goals, curricula, values, etc. In terms of complexity, AI technology should be perceived as difficult to use whether due to expertise or infrastructure. Lastly, observability means that the successes of AI-driven tools must be visible to serve as motivation to educators, institutions and students to adopt and/or sustain adoption of such innovations.

Ultimately this theory for this study clarifies the importance of communication, social systems and change agents in the diffusion of innovation which is AI in this instance. There are many important aspects and players and such there has to be collaboration between government agencies, education institutions, technology providers, entrepreneurial networks, etc. it also highlights that policy makers and academic leaders must create enabling environment through the provision of policy reforms, training as well as funding for adoption to be possible. We can also gather the importance of creating awareness about benefits, closing the capacity gap, having pilot implementation and the removing barriers to implementation. Hence, the integration of AI is a comprehensive, yet dynamic endeavour.

Empirical Review

Several empirical studies have explored the integration of AI into entrepreneurship education programs in Nigeria and beyond.

Bali (2024) explores the impact of AI on Nigeria's education. AI has prompted a shift towards technology-driven learning, evident in the rise of online platforms. Despite progress, many institutions lag in AI adoption. Bali aggregates AI implementations from developed countries, aiming to align Nigeria's education with global trends. Analysing papers from 2008 to 2022, the study finds widespread AI use in Nigerian education, including software modelling and student performance prediction. However, advanced AI techniques are underutilised. Bali suggests adopting practices from advanced nations to enhance learning opportunities and bridge the AI gap in Nigerian education.

In their paper "Entrepreneurship Education in the Era of Generative Artificial Intelligence," Bell and Bell (2023) address the rapid developments in generative artificial intelligence (AI) and its integration into entrepreneurship education. This trend reflects the increasing recognition of AI's potential to prepare students for future entrepreneurial opportunities and influence pedagogy and teaching practices. However, discussions about the implications of generative AI for education, especially entrepreneurship education, are limited, prompting calls for further

exploration. The paper addresses these calls by examining the potential implications of generative AI on entrepreneurship education at both macro and curricular levels. It emphasises the importance of entrepreneurship educators embracing AI in a managed way, fostering critical and reflective thinking among students, and developing practical and technical entrepreneurial skills to effectively utilise generative AI. Educators must also consider the potential effects of generative AI on teaching and assessment practices.

Benson and Ndana'acha (2023) in their study titled "Catalysing Nigeria's Economic Renaissance through Artificial Intelligence Empowerment" delves into the transformative role of artificial intelligence (AI) in driving Nigeria's economic revitalization. Through a comprehensive examination of AI applications across key sectors such as finance, agriculture, and healthcare. This review elucidates tangible examples of AI-driven innovation already underway within Nigeria. Moreover, it outlines the essential policy imperatives required to foster a conducive environment for AI adoption and proliferation, emphasising the importance of collaboration between government, industry, academia, and civil society. Despite the promising potential of AI, challenges including regulatory complexities and ethical considerations pose significant hurdles. However, by navigating these obstacles and leveraging AI's full potential, Nigeria can embark on a trajectory towards inclusive economic prosperity. This review underscores the imperative for concerted action and strategic foresight as Nigeria harnesses AI as a cornerstone of its economic transformation.

Giuggioli & Pellegrini (2023) present a systematic literature review titled "Artificial intelligence as an enabler for entrepreneurs," aiming to fill the gap in academic literature concerning the impact of AI on entrepreneurship. Through a systematic analysis of relevant studies, the research explores AI's role as a catalyst for entrepreneurs, particularly within the context of Industry 4.0 technologies such as smart factories, the Internet of Things (IoT), augmented reality (AR), and block chain. The study proposes a framework termed the "AI-enabled entrepreneurial process," which categorises AI's influence on entrepreneurship into four main aspects: opportunity identification, decision-making, performance enhancement, and education/research facilitation. The findings underscore the profound implications of AI for entrepreneurs and highlight its positive contributions across various dimensions of entrepreneurial activity. Moreover, the study emphasises the practical value of the framework for researchers, entrepreneurs, and aspiring entrepreneurs, providing actionable insights for leveraging AI's potential in entrepreneurial settings.

Similarly, Odeyemi (2023), in his paper titled "Leveraging on Innovation and Technological Entrepreneurship in achieving economic growth in Nigeria," underscores the pivotal role of innovation and technological entrepreneurship in driving economic growth, job creation, and sustainable development in today's global landscape. Nigeria, as Africa's largest economy, stands poised to

harness these critical elements to propel its own economic transformation. The paper delves into the potential of technological entrepreneurship as a catalyst for Nigeria's economic advancement, emphasising its capacity to generate employment opportunities and foster innovation. Through an analysis of the current landscape of technological entrepreneurship in Nigeria, the paper identifies challenges and barriers impeding its growth, while also examining government initiatives and key issues affecting its development. Drawing on global best practices and case studies, the paper offers valuable insights into successful strategies and approaches that can guide Nigeria's technological entrepreneurship ecosystem. In conclusion, the paper presents actionable recommendations for policymakers, entrepreneurs, and stakeholders to capitalise on Nigeria's technological potential and position the country as a prominent player in the global innovation ecosystem.

Some of the gaps in literature that may be observed include focus of many studies on impact of AI on productivity and labour market but not entrepreneurship education, there is also limited research on pedagogical integration into entrepreneurship education in Africa including Nigeria as most focus on more developed economies who do not usually have the same constraints we do. Also, there is policy and implementation gap in available literature.

These empirical studies provide valuable insights into the current state of AI integration in entrepreneurship education programs in Nigeria, identifying key barriers and opportunities for further development.

Methodology

This study adopted a qualitative research approach, utilising a literature analysis methodology to explore the integration of Artificial Intelligence (AI) into entrepreneurship education programs in Nigeria. The literature analysis approach allows for a comprehensive examination of existing academic literature, reports, and publications pertinent to the research topic (Snyder, 2019).

The literature review process involved a systematic search and selection of relevant academic articles, research reports, and publications from reputable sources. The search was conducted using various electronic databases, such as Google Scholar, ScienceDirect, JSTOR, as well as specialised repositories and journal databases relevant to the fields of entrepreneurship, education, and AI. The selection of literature was guided by a set of predefined inclusion and exclusion criteria to ensure the relevance and quality of the sources. Only peer-reviewed articles, research reports, and publications from credible sources were included in the review. The sources were screened based on their relevance to the research topic, the quality of the research methodology employed, and their publication in reputable academic journals or by recognized organisations.

The selected literature was then thoroughly analysed and synthesised to identify key themes, challenges, strategies, and best practices related to the integration of AI into entrepreneurship education programs. Particular attention was given to literature specific to the Nigerian context, as well

as global perspectives and experiences that could inform the development of effective strategies for AI integration in the country. The literature analysis approach enabled a comprehensive understanding of the current state of knowledge on the research topic, while also identifying gaps and areas for further exploration. The findings from this literature review will serve as a foundation for developing a comprehensive framework and recommendations for the effective integration of AI into entrepreneurship education programs in Nigeria.

Findings and Discussion

The literature analysis revealed several key strategies and barriers concerning the integration of Artificial Intelligence (AI) into entrepreneurship education programs in Nigeria.

Strategies for Effective Integration of AI

1. Leveraging Innovation and Technological Entrepreneurship: Odeyemi (2023) emphasises the importance of leveraging innovation and technological entrepreneurship as drivers of economic growth in Nigeria. The integration of AI into entrepreneurship education programs can foster an environment that encourages innovation, creativity, and the development of AI-driven entrepreneurial ventures. By equipping students with AI skills and knowledge, they can identify opportunities, create innovative solutions, and contribute to the country's economic renaissance (Benson et al., 2023).

2. Enhancing Entrepreneurship Development and Poverty Alleviation: Ndubuisi-Okolo and Anekwe (2018) highlight the role of entrepreneurship development in alleviating poverty in Nigeria. The integration of AI into entrepreneurship education can provide aspiring entrepreneurs with the tools and skills necessary to develop innovative and sustainable business models, thereby contributing to economic growth and poverty reduction. AI-enabled entrepreneurship can enhance productivity, efficiency, and market competitiveness, leading to increased job creation and income generation (Duan et al., 2019).

3. Fostering Sustainable Entrepreneurship and Innovation: Naudé (2020) explores the potential of AI in driving sustainable entrepreneurship and innovation. By incorporating AI concepts and applications into entrepreneurship curricula, students can learn to leverage AI technologies for developing eco-friendly business practices, optimising resource utilisation, and addressing environmental challenges. This alignment with sustainability goals can position Nigerian entrepreneurs as leaders in the global market (Agrawal et al., 2019).

4. Curriculum Development and Pedagogical Approaches: Ubogu (2020) emphasises the need for Entrepreneurship Education curricula to adapt to emerging trends and technologies. The integration of AI into entrepreneurship programs requires a comprehensive revision of existing

curricula, incorporating AI-specific courses, case studies, and practical assignments (Ogbari et al., 2016). Innovative pedagogical approaches, such as experiential learning, simulations, and industry collaborations, can provide students with hands-on experience in applying AI to entrepreneurial contexts (Enu, 2012).

5. Capacity Building and Resource Allocation: Effective AI integration necessitates significant investments in capacity building for educators and the provision of necessary resources (Bali, 2024). This includes professional development programs, infrastructure development, and collaborations with industry partners, AI research centres, and international organisations to facilitate knowledge transfer and resource sharing (Toh & Kwan, 2021; Touretzky et al., 2019).

6. Policy and Regulatory Frameworks: Developing comprehensive policy and regulatory frameworks is crucial for guiding and supporting the integration of AI into entrepreneurship education (OECD, 2019). These frameworks should address issues such as curriculum standards, ethical guidelines, data privacy, and intellectual property rights related to AI technologies (Giuggioli & Pellegrini, 2023). Additionally, policies should promote public-private partnerships and incentivize the adoption of AI in entrepreneurship education programs (Reagan, 2018).

Barriers to AI Integration

1. Infrastructural Challenges: Limited access to reliable infrastructure, such as high-speed internet, computing resources, and hardware, poses a significant barrier to the integration of AI into entrepreneurship education programs in Nigeria (Bali, 2024). These infrastructural deficiencies hinder the effective implementation of AI-related curricula and practical applications, particularly in resource-constrained educational institutions (Makridakis, 2017).

2. Limited AI Expertise and Resources: The lack of qualified educators and professionals with expertise in AI and related technologies is a major challenge for Nigerian institutions (Zahidi, 2020). This shortage of AI expertise limits the ability to develop and deliver effective AI-focused curricula and programs (Kaplan & Haenlein, 2019). Additionally, the limited availability of financial resources and funding for AI initiatives further exacerbates this issue (Russell & Norvig, 2020).

3. Curriculum and Pedagogical Limitations: Existing entrepreneurship education curricula in Nigeria often lack focus on emerging technologies like AI, and traditional pedagogical approaches may not be well-suited for imparting AI-related

knowledge and skills (Ubogu, 2020). Resistance to curricular changes and the adoption of innovative teaching methods can hinder the successful integration of AI into entrepreneurship programs (Ogbari et al., 2016).

4. Cultural and Societal Perceptions: Negative perceptions and misconceptions about AI's impact on employment and societal implications can create resistance and scepticism towards its integration into education (Chui et al., 2018). Additionally, cultural norms and traditional mind-sets may pose barriers to the acceptance and adoption of AI technologies in entrepreneurship education (Bell & Bell, 2023).

These findings highlight the need for a comprehensive and multi-faceted approach to address the barriers and effectively implement the identified strategies for integrating AI into entrepreneurship education programs in Nigeria. Collaborations among stakeholders, policy interventions, and sustained investments in infrastructure, capacity building, and curriculum development are crucial for fostering an AI-driven entrepreneurial ecosystem in the country.

Conclusion and Recommendations

This study aimed to explore the integration of Artificial Intelligence (AI) into entrepreneurship education programs in Nigeria, identifying strategies and barriers to its successful implementation. Through a comprehensive literature analysis, several key findings have emerged.

Summary of Key Findings

1. AI integration in Entrepreneurship Education offers significant opportunities for fostering innovation, sustainable entrepreneurship, and economic growth in Nigeria.
2. Effective strategies include leveraging technological entrepreneurship, enhancing entrepreneurship development for poverty alleviation, curriculum development, capacity building, and establishing supportive policy and regulatory frameworks.
3. Significant barriers to AI integration in entrepreneurship education programs include infrastructural challenges, limited AI expertise and resources, curriculum and pedagogical limitations, and cultural and societal perceptions.

Recommendation

In order to effectively integrate Artificial Intelligence (AI) into entrepreneurship education programs in Nigeria, a multi-faceted and collaborative approach is recommended. Firstly, policymakers should prioritise the development of comprehensive policies and regulatory frameworks that support and guide AI integration. These policies should address curriculum standards, ethical guidelines, data privacy, intellectual property rights, and incentives for AI adoption in education. Secondly, educational institutions should invest in capacity building for educators

through professional development programs, infrastructure development, and collaborations with industry partners, AI research centres, and international organisations. Curriculum development initiatives should incorporate AI-specific courses, case studies, and practical assignments, while also adopting innovative pedagogical approaches such as experiential learning, simulations, and industry collaborations. Additionally, stakeholders, including government agencies, industry partners, and civil society organisations, should collaborate to facilitate knowledge sharing, resource pooling, and the development of best practices. By addressing these recommendations, Nigeria can foster an AI-driven entrepreneurial ecosystem that drives economic growth and sustainable development.

Implications for Policymakers, Educators, and Stakeholders

1. Policymakers: The findings underscore the need for comprehensive policies and regulatory frameworks that support and guide the integration of AI into Entrepreneurship Education. These policies should address curriculum standards, ethical guidelines, data privacy, intellectual property rights, and incentives for AI adoption in education.

2. Educators: Educators play a crucial role in facilitating the successful integration of AI into entrepreneurship programs. This requires significant investments in capacity building, professional development, and the adoption of innovative pedagogical approaches that incorporate AI concepts and practical applications.

3. Stakeholders: Effective AI integration requires collaboration among various stakeholders, including educational institutions, government agencies, industry partners, and civil society organisations. These collaborations can facilitate knowledge sharing, resource pooling, and the development of best practices.

By addressing these recommendations, future research can contribute to a deeper understanding of the challenges and opportunities associated with AI integration in Entrepreneurship Education in Nigeria. This knowledge can inform effective policymaking, curriculum development, and stakeholder collaborations, ultimately fostering an AI-driven entrepreneurial ecosystem that drives economic growth and sustainable development in the country.

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