© JUN 2026 | IRE Journals | Volume 9 Issue 12 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I12-1719314

Artificial Intelligence, Innovation, And Entrepreneurship Education: Opportunities for Youth Empowerment

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Abstract- ***Artificial Intelligence (AI) has emerged as one of the most transformative technologies of the twenty-first century, significantly reshaping industries, economies, labour markets, and educational systems across the globe. The rapid advancement of AI-driven technologies has created new opportunities for innovation, entrepreneurship, and workforce development, particularly among young people. As nations increasingly transition toward digital and knowledge-based economies, entrepreneurship education must evolve beyond traditional business concepts to incorporate technological innovation, digital competencies, and AI-driven problem-solving skills. This paper examines the relationship between Artificial Intelligence, innovation, and entrepreneurship education and explores their collective potential for promoting youth empowerment. The paper discusses the concept of AI, its applications in entrepreneurship education and Technical and Vocational Education and Training (TVET), opportunities for enterprise creation and innovation, and challenges associated with AI integration. Drawing from Human Capital Theory and Innovation Theory, the paper argues that AI-enhanced entrepreneurship education can equip young people with future-ready competencies required for self-employment, employability, and sustainable economic participation. The paper concludes that effective integration of AI into entrepreneurship education can stimulate innovation, foster enterprise creation, reduce youth unemployment, and contribute to sustainable national development. It recommends that the integration of AI literacy into entrepreneurship curricula, increased investment in digital infrastructure, establishment of innovation hubs, strengthening of industry-education partnerships, and provision of financial support for youth-led AI enterprises.***

Keywords: ***Artificial Intelligence, Innovation, Entrepreneurship Education, Youth Empowerment, Digital Entrepreneurship, TVET, Employability, Fourth Industrial Revolution.***

I. INTRODUCTION

The twenty-first century has witnessed unprecedented technological advancement, resulting in significant transformations in economic activities, employment patterns, communication systems, and educational practices. The emergence of the Fourth Industrial Revolution (4IR) has accelerated the integration of digital technologies into nearly every aspect of human life. According to Schwab (2017), the Fourth Industrial Revolution is characterized by the convergence of physical, digital, and biological systems through technologies such as Artificial Intelligence (AI), robotics, cloud computing, big data analytics, the Internet of Things (IoT), and machine learning.

Among these technologies, Artificial Intelligence has become one of the most influential innovations driving global transformation. AI systems are increasingly utilized in manufacturing, healthcare, agriculture, transportation, finance, education, and business management. The World Economic Forum

(2025) observed that AI and automation technologies are transforming labour markets by creating new occupations while simultaneously redefining existing jobs. Consequently, educational institutions are under increasing pressure to prepare learners with competencies relevant to rapidly evolving digital economies.

Technical and Vocational Education and Training (TVET) institutions play a critical role in developing the skilled workforce required for technological and industrial development. According to Olowe (2024), technical education remains a vital instrument for workforce development because it equips learners with innovative, technical, and entrepreneurial competencies necessary for modern industries. As technological innovations continue to reshape workplaces, technical education must increasingly integrate digital and AI-related competencies into teaching and learning processes.

Entrepreneurship education has also gained prominence as an effective strategy for addressing unemployment, poverty, and economic dependency. Oviawe (2023) noted that entrepreneurship education equips learners with opportunity-recognition skills, innovative thinking abilities, and business management competencies necessary for creating and sustaining enterprises. Similarly, Okoye (2024) argued that technology-driven entrepreneurship education enables learners to identify business opportunities, create innovative solutions, and develop sustainable enterprises capable of competing in digital economies.

Despite improvements in educational access, youth unemployment remains a major challenge in many developing countries, including Nigeria. According to the International Labour Organization (2024), many young people face difficulties securing decent employment due to inadequate entrepreneurial capabilities and limited digital competencies. Willie, Odu, and Ayonmike (2024) further emphasized that digital skills have become essential requirements for employability, innovation, and lifelong learning in contemporary economies. Consequently, integrating Artificial Intelligence into entrepreneurship education presents a strategic opportunity for empowering youths with relevant competencies required for self-reliance, enterprise creation, and economic productivity.

II. CONCEPTS OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence refers to the capability of computer systems and machines to perform tasks that traditionally require human intelligence. Such tasks include learning, reasoning, decision-making, problem-solving, language understanding, and pattern recognition. Russell and Norvig (2021) described AI as the science and engineering of creating intelligent machines capable of perceiving their environment and taking actions that maximize the likelihood of achieving specified goals.

Similarly, Kaplan and Haenlein (2019) defined Artificial Intelligence as the ability of a system to interpret external data correctly, learn from such data, and utilize acquired knowledge to achieve specific objectives through flexible adaptation. UNESCO (2024) emphasized that AI has become a strategic resource capable of transforming education, research, workforce development, and innovation ecosystems globally.

In the context of education and entrepreneurship, AI facilitates personalized learning, intelligent tutoring, predictive analytics, automated assessment, business intelligence, and innovation management. Willie et al. (2024) observed that digital technologies, including AI systems, are increasingly transforming skills acquisition and workforce preparation within TVET institutions, thereby creating new opportunities for entrepreneurship and innovation.

Major AI technologies include:
- Machine Learning
- Deep Learning
- Natural Language Processing
- Computer Vision
- Robotics
- Expert Systems
- Predictive Analytics
- Generative Artificial Intelligence

Recent developments in Generative AI applications such as ChatGPT have expanded opportunities for business development, research, content creation, customer engagement, innovation management, and entrepreneurship (Dwivedi et al., 2023).

Human Capital Theory: Human Capital Theory was propounded by Becker (1964) and emphasizes investment in education, training, and skills development as major determinants of productivity and economic growth. The theory argues that individuals who acquire relevant knowledge and competencies become more productive and valuable contributors to economic development.

The theory is relevant to this study because entrepreneurship education and AI literacy represent forms of human capital investment capable of enhancing employability and entrepreneurial success. Olowe (2024) emphasized that workforce development in technical education depends largely on the acquisition of innovative and technological competencies. Similarly, Willie et al. (2024) maintained that digital skills development has become a critical component of human capital formation in contemporary societies. Therefore, integrating AI into entrepreneurship education can significantly enhance youths' productive capacities and economic opportunities.

Innovation Theory: Innovation Theory was developed by Schumpeter (1934), who identified innovation as the primary driver of entrepreneurship and economic development. According to the theory, entrepreneurs contribute to economic growth by introducing new products, services, production methods, and business models.

The theory is particularly relevant to AI-driven entrepreneurship because Artificial Intelligence serves as a catalyst for innovation by enabling the development of new products, services, and solutions. Okoye (2024) argued that technology-driven entrepreneurship encourages learners to utilize innovative approaches to solve societal and industrial challenges. AI therefore provides entrepreneurs with powerful tools for innovation, competitiveness, and enterprise growth.

III. ARTIFICIAL INTELLIGENCE AND ENTREPRENEURSHIP EDUCATION

Artificial Intelligence is increasingly becoming an indispensable component of entrepreneurship education in the twenty-first century. As businesses adopt intelligent technologies to improve productivity and competitiveness, entrepreneurship education must prepare learners to effectively utilize these technologies for enterprise development and innovation. According to Okoye (2024), entrepreneurship education in the digital era should extend beyond conventional business management concepts to include technological innovation, digital problem-solving, and AI-enabled enterprise development. The integration of AI into entrepreneurship education enables learners to develop competencies required for identifying opportunities, generating innovative ideas, and creating sustainable business ventures.

Personalized Learning: One of the most significant contributions of AI to entrepreneurship education is personalized learning. AI-powered educational systems can analyse learners' strengths, weaknesses, preferences, and learning patterns to provide customized instructional experiences. Such systems adapt learning materials to individual learners' needs, thereby improving engagement, understanding, and retention. Zawacki-Richter et al. (2023) and Holmes et al. (2022) reported that AI-supported instructional systems significantly improve learning outcomes and academic achievement. Willie et al. (2024) further noted that digital technologies facilitate learner-centred instruction and enhance skills acquisition within technical and vocational education environments.

Business Idea Generation and Innovation: Artificial Intelligence provides entrepreneurs with powerful tools for identifying market opportunities and generating innovative business ideas. Through predictive analytics, market intelligence systems, and data mining technologies, entrepreneurs can analyse consumer behaviour, identify emerging trends, and evaluate market demands. Okoye (2024) emphasized that technology-driven entrepreneurship education

promotes creativity, innovation, and opportunity recognition among learners. Consequently, students can utilize AI tools to develop innovative products, services, and business models capable of addressing societal and industrial challenges.

Digital Marketing and Customer Engagement: AI technologies have transformed digital marketing practices by enabling customer segmentation, personalized advertising, content creation, customer relationship management, and social media engagement. AI-powered systems help entrepreneurs understand customer preferences and deliver tailored services that improve customer satisfaction and business performance. According to OECD (2024), businesses that effectively utilize AI-driven marketing tools often experience improved competitiveness and market responsiveness.

Business Automation: Artificial Intelligence automates repetitive business functions such as inventory management, customer support services, bookkeeping, scheduling, and data processing. Brynjolfsson and McAfee (2014) observed that automation enhances operational efficiency and allows entrepreneurs to focus on strategic decision-making and innovation. For young entrepreneurs operating with limited resources, AI-powered automation provides opportunities to improve productivity while minimizing operational costs.

Data-Driven Decision Making: Modern entrepreneurship increasingly depends on accurate and timely information. Artificial Intelligence systems process large volumes of data and generate actionable insights that support informed decision-making. Entrepreneurs can utilize predictive analytics to forecast demand, evaluate risks, identify investment opportunities, and improve strategic planning. Such capabilities contribute significantly to business sustainability and growth.

IV. ARTIFICIAL INTELLIGENCE, INNOVATION, AND YOUTH EMPOWERMENT

Youth empowerment involves equipping young people with the knowledge, skills, resources, and opportunities required to participate effectively in economic and social development. In contemporary societies, digital competence has become a fundamental requirement for meaningful participation in economic activities. Willie et al. (2024) argued that digital skills development is essential for employability, entrepreneurship, and lifelong learning. Consequently, AI-enhanced entrepreneurship education provides a viable pathway for reducing unemployment and promoting economic inclusion among young people.

Creation of New Business Opportunities: Artificial Intelligence has created numerous entrepreneurial opportunities across various sectors of the economy. Emerging areas include software development, mobile application development, e-commerce, digital content creation, educational technology, financial technology (FinTech), cybersecurity services, digital consulting, and intelligent business solutions. These sectors provide significant opportunities for young entrepreneurs to establish innovative enterprises capable of generating income and creating employment opportunities.

Enhanced Employability: The increasing adoption of AI technologies across industries has created demand for workers with digital and technological competencies. The World Economic Forum (2025) identified AI literacy, digital competence, analytical thinking, creativity, and technological proficiency among the fastest-growing workforce skills globally. Young people equipped with such competencies possess greater opportunities for securing employment and adapting to changing workplace demands.

Promotion of Innovation and Creativity: Innovation is a critical driver of entrepreneurship and economic development. Olowe (2024) emphasized that innovation-oriented education enhances learners' abilities to generate ideas, solve practical problems, and contribute to technological advancement. Artificial Intelligence stimulates creativity by assisting users in generating ideas, analysing complex situations, and developing innovative solutions to societal challenges. Entrepreneurship education that integrates AI therefore encourages learners to

become creators and innovators rather than passive consumers of technology.

Access to Global Markets: AI-enabled digital platforms allow entrepreneurs to connect with customers across geographical boundaries. Through online marketplaces, intelligent marketing systems, and global value chains, young entrepreneurs can access international markets and expand their customer base. Such opportunities contribute significantly to enterprise growth and economic empowerment.

Financial Inclusion: Artificial Intelligence has transformed financial services through intelligent credit assessment systems, digital lending platforms, automated investment advisory services, and mobile banking applications. These technologies improve access to financial resources for young entrepreneurs who often face challenges in obtaining traditional business financing.

Self-Reliance and Wealth Creation: AI-driven entrepreneurship provides alternative pathways for income generation and wealth creation. By establishing technology-enabled enterprises, young people can reduce dependence on public-sector employment and become active contributors to economic development. This promotes self-reliance, economic independence, and sustainable livelihoods.

V. APPLICATION OF ARTIFICIAL INTELLIGENCE IN TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET)

Technical and Vocational Education and Training (TVET) institutions play a strategic role in preparing learners for AI-driven workplaces and entrepreneurial opportunities. Olowe (2024) emphasized that workforce development in technical education requires continuous integration of emerging technologies into instructional and practical training activities. Similarly, Willie et al. (2024) stressed that digital transformation within TVET institutions is essential for preparing graduates for Industry 4.0 occupations.

Automobile Technology

Artificial Intelligence is transforming the automobile industry through intelligent vehicle diagnostic systems, predictive maintenance technologies, smart vehicle systems, autonomous driving technologies, and computer-assisted repairs. Students trained in AI-enabled automotive systems can establish businesses specializing in vehicle diagnostics, maintenance services, and intelligent transportation solutions.

Building Technology

In Building Technology, AI supports smart construction practices, Building Information Modelling (BIM), project planning, automated site monitoring, risk assessment, and resource management. These technologies improve construction efficiency while creating entrepreneurial opportunities in smart building development and project management.

Electrical/Electronics Technology

Artificial Intelligence contributes significantly to electrical and electronics technology through smart grid systems, intelligent energy management, automated fault detection, and renewable energy optimization. Graduates with competencies in these areas can establish businesses focused on energy solutions, smart installations, and electronic automation systems.

Metalwork Technology

AI applications in metalwork include robotic welding systems, automated manufacturing processes, computer-aided production systems, and intelligent quality control technologies. Such innovations enhance productivity while creating opportunities for technology-based manufacturing enterprises.

Woodwork Technology

Woodwork technology increasingly utilizes AI-powered Computer Numerical Control (CNC) systems, intelligent furniture design software, automated production technologies, and smart manufacturing systems. Entrepreneurs equipped with these competencies can establish modern furniture production enterprises capable of competing in local and international markets.

VI. HOME ECONOMICS AND HOME MANAGEMENT

Artificial Intelligence is increasingly transforming Home Economics and Home Management through smart technologies, digital innovation, and entrepreneurship development. AI-powered applications support food planning, nutrition analysis, meal management, textile and clothing design, family resource management, interior decoration, and hospitality services. Smart kitchen devices, automated inventory systems, and nutrition-monitoring applications enable learners to make informed decisions regarding food preparation, health, and household management.

In Clothing and Textiles, AI facilitates computer-aided fashion design, virtual fitting technologies, trend forecasting, and personalized garment production. Learners can utilize AI tools to develop innovative fashion enterprises and improve productivity within the textile industry. In Hospitality and Catering Management, AI supports customer service automation, reservation systems, menu planning, and business analytics, thereby creating opportunities for entrepreneurial ventures in catering, event management, and hospitality services.

Furthermore, AI-powered budgeting and resource management applications assist individuals and families in making efficient financial decisions, while smart home technologies promote effective household management and sustainability. The integration of AI into Home Economics and Home Management therefore equips learners with digital, entrepreneurial, and managerial competencies required for self-reliance, innovation, and participation in the modern economy.

The integration of AI into TVET programmes not only enhances technical competence but also strengthens entrepreneurial capabilities, thereby promoting sustainable youth empowerment and economic development.

VII. CHALLENGES OF INTEGRATING ARTIFICIAL INTELLIGENCE (AI) INTO ENTREPRENEURSHIP EDUCATION

Despite the enormous benefits associated with Artificial Intelligence, several challenges continue to hinder its effective integration into entrepreneurship education, particularly in developing countries. These challenges includes:

Inadequate Digital Infrastructure: The successful implementation of AI-driven entrepreneurship education requires reliable internet connectivity, stable electricity supply, modern computer facilities, and access to digital technologies. However, many educational institutions, especially in developing countries, continue to face infrastructural deficiencies that limit the adoption of AI technologies.

Limited AI Literacy among Educators and Learners: Many educators and students lack adequate knowledge and skills required to effectively utilize Artificial Intelligence tools for teaching, learning, and business development. Willie et al. (2024) noted that the shortage of digital competencies among educators remains a major obstacle to technology integration within TVET institutions.

High Cost of Technological Resources: The acquisition, maintenance, and upgrading of AI technologies often require substantial financial investment. Educational institutions with limited funding may find it difficult to procure the necessary hardware, software, and internet services required for AI implementation.

Ethical and Privacy Concerns: Artificial Intelligence raises concerns relating to data privacy, cybersecurity, intellectual property rights, algorithmic bias, and ethical decision-making. Educational institutions must therefore ensure responsible and ethical utilization of AI technologies.

Digital Divide: Significant disparities exist between urban and rural communities regarding access to digital technologies and internet services. Such inequalities may widen educational and economic gaps among learners if not adequately addressed.

Insufficient Funding: Many entrepreneurship education programmes suffer from inadequate funding, which limits investments in innovation

laboratories, digital infrastructure, research activities, and capacity-building initiatives.

Resistance to Technological Change: The adoption of AI technologies often encounters resistance from educators, administrators, and learners who may be unfamiliar with emerging technologies or concerned about job displacement and technological complexities.

Weak Policy Support and Institutional Frameworks: Okoye (2024) observed that inadequate policy support, weak implementation strategies, and insufficient collaboration among stakeholders often hinder the successful integration of emerging technologies into educational programmes.

VIII. STRATEGIES FOR MAXIMIZING AI FOR YOUTH EMPOWERMENT

To fully harness the transformative potential of Artificial Intelligence (AI) for entrepreneurship education and youth empowerment, the following strategies should be adopted:

1. Integrate AI literacy, digital entrepreneurship, and innovation education into curricula at all educational levels, particularly within TVET programmes, to equip learners with future-oriented technical and entrepreneurial competencies.
2. Establish and strengthen innovation ecosystems through AI laboratories, innovation hubs, technology incubation centres, and entrepreneurship development centres within educational institutions to promote creativity, research, and enterprise creation.
3. Invest in digital infrastructure and technological resources, including reliable internet connectivity, electricity supply, modern computer facilities, and AI-enabled learning environments to facilitate effective teaching, learning, and innovation.
4. Enhance capacity building for educators and learners through specialized AI training programmes, professional development initiatives, and continuous skills upgrading, particularly in TVET disciplines such as Automobile Technology, Building Technology, Electrical/Electronics Technology, Metalwork Technology, Woodwork Technology, Home Economics, and Home Management.
5. Promote collaboration among government, industries, research institutions, financial organizations, and educational institutions to facilitate technology transfer, curriculum relevance, practical training, and workforce development.
6. Provide financial and institutional support for AI-driven innovation and entrepreneurship, including grants, scholarships, venture capital, startup funding, soft loans, innovation competitions, hackathons, technology exhibitions, and business incubation programmes for young entrepreneurs.
7. Encourage ethical, responsible, inclusive, and sustainable use of AI while supporting research, product development, and access to global digital opportunities, thereby ensuring that youth can leverage AI for innovation, employability, enterprise growth, and sustainable economic participation.

IX. CONCLUSION

Artificial Intelligence has emerged as one of the most disruptive and transformative technologies of the twenty-first century, creating unprecedented opportunities for innovation, entrepreneurship, and workforce development. The integration of AI into entrepreneurship education provides a strategic pathway for equipping young people with the competencies required to thrive in rapidly changing digital economies. Through personalized learning, business innovation, digital marketing, automation, and data-driven decision-making, AI enhances entrepreneurial capabilities and expands opportunities for enterprise creation.

Furthermore, the incorporation of AI into Technical and Vocational Education and Training programmes strengthens technical competence, employability, creativity, and innovation across disciplines such as Automobile Technology, Building Technology, Electrical/Electronics Technology, Metalwork

Technology, Woodwork Technology, Home Economics and Home Management. As emphasized by Olowe (2024), workforce development in technical education requires continuous adaptation to emerging technologies. Similarly, Okoye (2024) highlighted the importance of technology-driven entrepreneurship, while Willie et al. (2024) stressed the growing significance of digital skills for employability and lifelong learning.

Therefore, effective integration of Artificial Intelligence into entrepreneurship education has the potential to reduce youth unemployment, promote self-reliance, stimulate enterprise development, foster innovation, and contribute significantly to sustainable national development. Achieving these outcomes, however, requires collaborative efforts among governments, educational institutions, industries, and other stakeholders to address existing infrastructural, financial, and policy challenges.

X. RECOMMENDATIONS

Based on the discussions in this paper, the following recommendations are made:

1. Artificial Intelligence, digital entrepreneurship, and innovation education should be integrated into entrepreneurship and TVET curricula at all educational levels to equip learners with future-ready competencies required for employment and self-employment.
2. Government and educational stakeholders should invest in digital infrastructure, AI laboratories, innovation hubs, entrepreneurship incubation centres, reliable internet connectivity, and stable electricity supply to support effective AI integration in educational institutions.
3. Continuous professional development programmes should be organized for educators, instructors, and TVET trainers to enhance their AI literacy, digital pedagogical skills, and capacity to utilize emerging technologies in teaching and learning.
4. TVET institutions should incorporate practical AI applications across all vocational disciplines, including Automobile Technology, Building Technology, Electrical/Electronics Technology, Metalwork Technology, Woodwork Technology, Home Economics, and Home Management, to strengthen technical and entrepreneurial competencies.
5. Strong partnerships should be established among government agencies, industries, research institutions, and educational organizations to facilitate technology transfer, collaborative research, industrial attachment opportunities, and curriculum relevance.
6. Government, financial institutions, and private organizations should provide grants, scholarships, soft loans, venture capital support, and startup funding for youth-led AI-driven enterprises and innovation projects.
7. Policies promoting ethical, responsible, inclusive, and sustainable use of Artificial Intelligence should be developed and effectively implemented, while encouraging innovation competitions, technology exhibitions, and entrepreneurship fairs that foster youth participation in AI-driven enterprise development.

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