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DIGITAL TRANSFORMATION, AI, AND BLOCKCHAIN: THE FUTURE OF THE IGBO APPRENTICESHIP SYSTEM

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ABSTRACT

The digital revolution has significantly enhanced the global financial system over the years. The development and application of digital transformation, AI and Blockchain in the Igbo apprenticeship system has reduced the challenges in the apprenticeship system in Igbo land, thereby promoting the growth of the future Igbo apprenticeship system. This study investigates the impact of digital transformation, leveraging AI and blockchain technology on the future of the Igbo apprenticeship system. The specific objectives were: to analyze the implication to which digital transformation AI improve knowledge acquired from Igbo apprenticeship system; to examine the extent to which digital transformation improve transparency and trust in the Igbo apprenticeship system; and to explore how digital transformation can boost the Small and Medium Enterprise (Igbo apprenticeship system inclusive) and economic growth. The study adopted a comprehensive synthesis of insights from existing literature and case studies, the research identifies the extent which digital transformation improves knowledge acquired, examines transparency and trust and also boost the SME and economic growth. The findings highlight the important of digital transformation, between apprentices and their masters facilitate learning and improve access to resources. Based on the findings it is recommended that there should be a comprehensive digital transformation within the Igbo apprenticeship system to enhance the knowledge acquisition of apprentices, increase transparency & trust between apprentice and the master and boost the SME and increase the economic growth.

Key words: *Artificial Intelligent (AI), Blockchain, Digital Transformation, Igbo Apprenticeship System*

INTRODUCTION

The Igbo Apprenticeship System (IAS) a longstanding business mentorship tradition among the Igbo people of southeastern Nigeria, has played a vital role in fostering wealth creation, entrepreneurship, community and economic growth, by integrating digital transformation, artificial intelligence (AI) and blockchain technology. The future of the Igbo Apprenticeship system can be modernized to enhance its scalability, transparency and relevance in the contemporary digital economy. The rapid advancement of technology has significantly transformed various system and the Igbo apprenticeship system is no exception. The apprenticeship entails practical, on-the job training, providing a platform for skill acquisition and development in the informal sector. It allows the unemployed to receive training and work as quasi-wage-earning journeymen while learning on the job (Adeyeye, *et el* 2015).

According to Ugwu, *et el* (2023) small and medium- sized enterprises are vital to local economic development, acting as key derivers of innovation, employment, and diversification.

These developments facilitate the seamless transfer of funds between the Igbo apprenticeship system and the engagement of businesses and customers in the real-time digital transaction, which has altered the global business system over the past three decades. Apprenticeship is a globally practiced training and skill development approach used for years to equip learners with occupational skills (Lerman, 2012, cited in Ejo-Orusa & Mpi, 2019). The Igbo apprenticeship system embodies a centuries-old tradition that has facilitated the transfer of skills, knowledge, and resources from one generation to the next, rooted in cultural heritage and steeped in communal values (Emeali, et al., 2023). The transaction, particularly in developing economics, has substantially change the business infrastructure, improving efficiency and business stability (Panagariya, 2022). This has also been applicable in the Igbo apprenticeship system in Igboland Nigeria.

The development and application of digital transformation, AI and Blockchain in the Igbo apprenticeship system has reduced the challenges in the apprenticeship system in Igbo land, thereby promoting the growth of the future Igbo apprenticeship system. The most significant impact of digital transformation of AI and Blockchain in Igbo apprenticeship system is the inclusive finance which has made financial services accessible to Igbo apprentices when they are settled, that is the elapse of the timeframe of the apprenticeship agreement. As the digital age continues to make its way into the global business, challenges exist and established, changes are noticed in the traditional paradigms (Enaifoghe, 2021). This factor plays a crucial role in influencing the operations of Small and Medium Scale (SMS) business which the Igbo apprenticeship is no exception. Impacting its ability to manage the constraints of digital transformation and take advantage of emerging opportunities (Nosike, 2024; Omol,2023; Bryda & Costa, 2023; Qureshi, 2022). The Igbo apprenticeship system finds it more difficult to constituent with the new system of digitalization which has brought us into the era of digital transformation of the Igbo apprenticeship system. Thus, the advent of digital technologies has provided us with great experience improvement in economic growth and general innovation in the system (Dornberger, & Schwaferts, 2021; Ghosh, *et el* 2022). Even with the astonishment sensation from the arrival of digital technologies in the economy, the Igbo apprenticeship system has been existing for a long-time, well-established finds it challenging to practice in the model global transformation.

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Despite these advantages, the integration of Igbo apprenticeship system into digital transformation AI and Blockchain technologies, can lead to descriptive to traditional learning structure and erosion of cultural value which the Igbo apprenticeship system has been known from its existence. Privacy and data security are also significant ethical concern associated with digital transformation (Quach, *et el* 2022).

Objectives

The main objective of the study is to analyze the impact of Digital Transformation, AI and Blockchain: The future of the Igbo Apprenticeship System. Therefore, this study tried to examine and analyze the impact of digital transformation on traditional practices of the Igbo apprenticeship system. It seeks to explore how the integration of digital technologies could shape the future of the Igbo apprenticeship model. Through a study that incorporates historical insight, socio-economic dynamics and technological development. Thus, the specific objective is;

1. to analyze the implication to which digital transformation, AI improve knowledge acquired from Igbo apprenticeship system,
2. to examine the extent to which digital transformation improve transparency and trust in the Igbo apprenticeship system and
3. to explore how digital transformation can boost the Small and Medium Enterprise (Igbo apprenticeship is inclusive) and improves economic growth.

LITERATURE REVIEW

Empirical Review

Several empirical studies have delved into the adoption of digital tools in their business; Bruce, et.al. (2023) investigated Digital Marketing Adoption's effect on SMEs' Sustainable Growth in Ghana, with findings indicating that while attitudes towards digital marketing didn't influence adoption intention, subjective norms and perceived behavior control did, with a direct positive link between subjective norms and actual digital marketing use. Radicic, &Petković, (2023) explored digitalization's Impact on Technological Innovations in German SMEs, finding heterogenous effects depending on digitalization form and innovation type, moderated by internal R&D activities.

Vrontis, et al. (2022) focused on the Adoption of Digital Technologies by Indian SMEs for Sustainability and Value Creation, highlighting digital tech's potential to enhance economic sustainability and social value, while Salah & Ayyash (2024) examined E-commerce Adoption in Palestinian SMEs, revealing positive effects on marketing performance,

influenced by AI integration, innovation culture, and customer tech-savviness within the TOE framework. These studies collectively underscore the multifaceted dynamics shaping SMEs' digital transformation and its implications for market adaptability and sustainability, offering insights crucial for policymaking and managerial strategies in fostering SME growth and resilience.

Agama and Ohajionu (2021) further posited that the apprenticeship scheme is of two types, namely 'learning a skilled work' and 'learning trade' and that former is focused on acquiring a handicraft, while the latter is focused on learning the rudiments of trade and commerce. However, the principles and practices of both are the same. The Igbo apprenticeship model is unstructured and informal, with the master's delegating authority to the most senior Apprentice (oldest Apprentice), who in turn delegates part of the authority to the next Apprentice down the line.

Ekesiobi and Dimnwobi (2020) carried out an empirical study to assess the effect of the Igbo Entrepreneurship Model (i.e. Igbo Apprenticeship practice Igba-Boi) on enterprise performance (business survival rates, income growth, access to trade credit, ease of customer acquisition, etc) of participants and non-participants of the IEM. Using a sample size of 1187, Propensity Score Matching (PSM) technique was employed to estimate the effects of treatment on the treated and control groups. The study reported that entrepreneurs who went through the IEM recorded higher business growth rate, business survival rate, and access to trade and informal credit. Ugbaja (2019) reported that the Igbo apprenticeship practices (Imu Ahia) drives entrepreneurial activities, stimulates self-employment, and can be useful for tackling the problem of youth unemployment in Nigeria.

Anigbogu, Onwuteaka, and Okoli, (2019) posited that the type of apprenticeship system being practiced among the Igbo ethnic group is arranged in a way that the Apprentice resides and serves his or her craft master for some time, after which the master settles the Apprentice by setting up a business, and this is done by paying his rent and gifting him or her goods or cash to start his or her business with. The Apprentice is also expected to leverage the skills, knowledge, and networks gained while serving his craft master to grow his business when independent. The master and apprentice relationship under this model are mutual and complementary; while the mentee is receiving training, he or she is also expected to contribute to the growth of his or her master's business, and the relationship transcends the apprenticeship period and after settlement. The mentee continues to seek and receive support from his or her master, and this after-settlement support guarantees that the mentee succeeds in his or her own business.

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Ezenwakwelu, et al. (2019) examined the technical and entrepreneurial skills for self-employment through formal and informal apprenticeship training systems- they revealed that lack of qualified manpower, lack of start-up capital and insufficient training tools impedes the course of apprenticeship acquisition of sufficient skills and knowledge for business set up. Similar findings were reported by Igwe, Newberry, et.el (2018) using key informant interview approach with 50 participants across the five South-Eastern States of Nigeria. An analytical investigation was done by Chinweuba and Ezeugwu (2017) with the aim to ascertain the peculiar sources, conditions and competencies that are pivotal to the increasing socio-economic ascendancy of the Igbo people.

Theoretical Review

Social Learning Theory

The paper adopted and applied the social learning theory in the understanding of the Igbo Apprentice System. The social learning theory is a general theory of human behavior, proposed by Bandura (1977) in Alberta, Canada, Bandura (1963) theorizes that learning is a cognitive process that takes place in a social context. According to the theory, three ways in which apprentices learn are purely through observation or direct instruction or through the observation of rewards and punishments, a process known as vicarious reinforcement, scaffolding, modeling, mentoring, and coaching are all methods of teaching and learning that draw on social constructivist learning theory. Bandura (SLT) shows that children naturally imitate the behavior of their modeling without needing or receiving a direct reward for the new behavior. Bandura's major premise is that a servant can learn by observing his/her masters/mistress who serves as a model. He claims that modeling can have as much impact as direct experience. Bandura (1993) posits that in order for modeling to be successful, the learner must be attentive, must have access to and retain the information presented, must be motivated to learn, and must be able to accurately reproduce the desired skill.

In the context of this study, the social learning theory holds particular relevance to the Igbo apprenticeship system, where individuals learn their craft by closely observing and imitating their masters. This process of learning by doing is highly valuable, as it enables apprentices to gain practical experience and refine their skills under the guidance of skilled practitioners. By keenly observing the actions and techniques of their masters, apprentices can acquire valuable insights and techniques that contribute to their growth and development. Bandura's theory of observation and imitation finds practical application in various workplace settings, where beginners learn by emulating the actions of experienced workers. Prior to actively engaging in their craft, apprentices benefit from carefully observing how skilled practitioners

perform their tasks. Through this process, apprentices absorb not only the technical aspects of the craft but also the underlying principles, strategies, and nuances that contribute to mastery. While the master's teaching approach may not align with modern instructive principles, the apprenticeship program facilitates the training process. It provides a structured environment where apprentices can learn from their masters, ask questions, seek clarifications, and engage in discussions to deepen their understanding. This dynamic interaction between the apprentice and the master fosters an immersive learning experience beyond passive observation. Bandura's social learning theory encompasses four fundamental components: attention, retention, reproduction, and motivation.

i. Attention refers to the apprentice's focused observation of the master's actions, paying close attention to the details and intricacies of the craft.
ii. Retention involves retaining the observed behaviours and techniques in memory for future application.
iii. Reproduction component entails applying the acquired knowledge and skills in practical situations and engaging in the craft with increasing competence.
iv. Motivation is critical in sustaining the apprentices' commitment to learning and drive to excel, providing the impetus for continuous improvement and growth (Kings, 2005).

The social learning theory, as proposed by Bandura, offers a valued understanding of the Igbo apprenticeship system despite some apparent shortcomings. It highlights the importance of observational learning, where apprentices acquire knowledge and skills by observing and imitating their masters. This aligns with the cultural context of the Igbo people, where close mentorship and hands-on experience play a crucial role in skill development. Bandura's theory recognizes the integration of cognitive and behavioural factors, highlighting the cognitive processes and decision-making involved in the apprenticeship process. Moreover, the theory's emphasis on motivation sheds light on the commitment and dedication displayed by apprentices, driven by the desire for mastery and entrepreneurial success. Many sociologists have critiqued social learning theory for failing to account for individual differences in learning and behaviour adequately. Critics argue that the theory overlooks the role of innate traits, personality factors, and genetic predispositions in shaping human behaviour (Bergh & Theron, 2006). Additionally, social learning theory tends to oversimplify complex behaviours by attributing them solely to observational learning, neglecting other influential factors such as biological, cultural, and contextual elements (Bergh & Theron, 2006). However, it is essential to acknowledge that social learning theory still offers valuable insights, particularly in the context of observational learning and skill acquisition.

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METHODOLOGY

This study employed a qualitative research design to explore the applications of digital technologies on Igbo apprenticeship system. A qualitative approach is appropriate for this research as it allows for an in-depth understanding of complex issues and the contextual factors influencing them (Creswell & Poth, 2018). The study adopts an exploratory design, aiming to uncover insights and generate hypotheses rather than test predefined theories. This approach is particularly suitable given the nascent stage of research on the digital transformation AI and block-chain on Igbo apprenticeship system. To achieve a comprehensive understanding of the digital transformation of the Igbo apprenticeship, the study utilized multiple data collection methods: literature review and case studies. The literature review involved a systematic examination of existing academic and professional literature on the subject. This includes peer-reviewed journal articles, books, conference papers, and oral interview with mentors and mentees (masters and apprentices). The review aims to identify key themes, trends, and gaps in the current understanding of the digital transformation of AI, and blockchain in Igbo apprenticeship system. Databases such as JSTOR, Google Scholar, and Scopus are used to source relevant literature. On the other hand, the Case studies provided detailed insights into real-world applications of digital technologies in Igbo apprenticeship system and issues that arise. This method involves the selection of specific instances where digital technologies AI, or blockchain have been implemented in Igbo apprenticeship. Each case is analysed to understand the challenges encountered and the strategies employed to address them (Yin, 2018). The case studies are chosen based on their relevance, availability of data, and the diversity of contexts they represent.

The data collected through the literature review and case studies are analysed using thematic analysis and content analysis techniques. Thematic analysis was used to identify, analyse, and report patterns (themes) within the data. This method involved coding the data and organizing it into meaningful categories that reflect the key themes related to the application of digital transformation of Igbo apprenticeship system (Booth et al., 2016). The themes are then interpreted to understand the broader implications and to generate insights that address the research objectives. For the Content analysis method, it was employed to systematically analyse the textual data from the literature review. This technique involves quantifying and analysing the presence, meanings, and relationships of certain words, themes, or concepts within the data (Krippendorff, 2018). Content analysis helps in identifying the frequency and significance of different issues discussed in the literature, providing a structured way to interpret the data.

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RESULTS AND DISCUSSIONS

AI and Igbo Apprenticeship System

AI Transformation on Igbo Apprenticeship System

The integration of Artificial Intelligence (AI) and automation in Igbo apprenticeship system has significantly transformed routine tasks, enhancing efficiency and effective performance in the apprenticeship system. AI-driven systems can automate repetitive tasks in the Igbo apprenticeship system such as the social learning process that involves observations, imitating, data entry, invoice processing, and all the aspect of teaching and learning process, which traditionally required substantial manual effort. According to Eziefule et al. (2024). This automation not only accelerates these processes but also minimizes human errors, thereby improving the reliability of any business activities. AI-powered learning platforms can enhance training and knowledge sharing, personalize learning pathways, providing apprentices with tailored content and guidance based on their individual needs and skill levels, which traditionally required substantial manual effort. AI can power language translation, this help overcome language barriers, making the apprenticeship system more accessible to a wider range of individuals. It can help resource management "Oga" optimize resource allocation, track inventory, and manage business operations more efficiently.

Implications: Apprenticeship Displacement, Accountability and Transparency

While AI and automation offer numerous benefits, they also raise significant challenges, particularly regarding apprentice displacement. One of the primary issues is the potential for apprentice displacement. As AI systems take over routine tasks, there is a risk that Igbo apprenticeship system may find their roles redundant. This concern is echoed by Eziefule et al. (2024), who highlight the need for system to adapt by acquiring new skills into the system and technology integration. Apprenticeship system must invest in reskilling and upskilling initiatives to prepare their mentees (apprentice) for the evolving landscape.

Accountability is another critical consideration. AI systems, while highly efficient, are not infallible. Errors or biases in AI application in the apprenticeship system can lead to deviation of interest by the apprentice, which can automatically destroy the system, incorrect information which can lead to wrong decisions or reporting on the part of the mentors and the mentees. Determining responsibility for such errors can be challenging, as it may not be clear whether the fault lies with the AI system, its developers, or the users. This necessitates the development of robust frameworks and guidelines to govern the use of AI in Igbo apprenticeship system, ensuring that appropriate and suitable AI technology is established, clearly defined and maintained (Krippendorff, 2018).

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Transparency is also a major ethical concern. AI systems often operate as "black boxes," making decisions based on complex algorithms that are not easily understood by humans specially the lay man. This lack of transparency can undermine trust in AI-driven processes and outcomes. To address this, it is essential to implement measures that enhance the explainability of AI systems, allowing stakeholders to understand how decisions are made and ensuring that these processes are fair and unbiased (Braun & Clarke, 2006).

Blockchain and Igbo Apprenticeship System

Blockchain Transformation on Igbo Apprenticeship System

Blockchain technology has emerged as a transformative force in Igbo apprenticeship system, offering significant benefits for system transparency and trust. At its core, blockchain is a decentralized ledger system that records transactions across multiple computers in a way that ensures the data is immutable and transparent. This characteristic is particularly valuable in Igbo apprenticeship system, where the integrity and accuracy of performance are paramount. One of the primary benefits of blockchain in any system is its ability to enhance transparency. By providing a single, immutable ledger that is accessible to all authorized parties, blockchain ensures that all transactions are recorded in a transparent manner. This reduces the risk of discrepancies and fraud, as every transaction is visible and verifiable by all participants (Sheela et al., 2023). Additionally, the use of smart contracts—self-executing contracts with the terms of the agreement directly written into code—further enhances transparency by automating and enforcing contractual obligations without the need for intermediaries (Deloitte, 2019).

Blockchain-based knowledge repositories, can create a secure and transparent record of training materials, mentorship sessions, and apprentices' progress, ensuring access and accountability. Virtual mentorship and collaboration, technology can facilitate virtual mentorship sessions and collaborative learning platforms, allowing apprentices to connect with experts and peers regardless of location. Blockchain-based supply chain management can improve transparency and efficiency in sourcing materials and managing supply chains. Blockchain technology which create a transparent and secure system for tracking and verifying payments between apprentices, "Oga" (mentors), and other stakeholders, mitigating disputes and fostering trust. Which enhance the tracking and settlement of payment that will improves the transparency and trust in the apprenticeship practice. According to Saleem, et.el (2023) Blockchain can enhance the detection of irregularities and ensure compliance with regularity standard.

Implication: Challenges of Blockchain Technology on Igbo Apprenticeship System

Despite its numerous benefits, the adoption of blockchain technology in any business also raises significant challenges, particularly concerning privacy and data protection. One of the primary concerns is the transparency of blockchain, which sometimes may not be beneficial for both the master and the apprentice, can also lead to privacy issues. Since all transactions are recorded on a public ledger, sensitive information could potentially be exposed to unauthorized parties. This is particularly concerning in cases where personal data is involved, as it could lead to breaches of privacy and confidentiality (Bellucci et al., 2022). Another challenge is the issue of data protection. While blockchain is highly secure, the immutability of the data means that once information is recorded, it cannot be altered or deleted. This poses a challenge for data protection regulations, such as the General Data Protection Regulation (GDPR) in the European Union, which grants individuals the right to have their personal data erased. The conflict between the immutability of blockchain and the right to be forgotten presents a significant ethical and legal dilemma that needs to be addressed (Wylde et al., 2022; Wen et al., 2023). Moreover, the decentralized nature of blockchain can complicate data governance. In a traditional centralized system, data governance policies and procedures are typically managed by a single entity. However, in a decentralized blockchain system, data governance must be coordinated among multiple parties, which can lead to inconsistencies and challenges in ensuring compliance with data protection regulations (Kanaparthi, 2024; Elshqirat, 2023). This requires the development of new governance frameworks that can effectively manage data protection in a decentralized environment (Sundarasen et al., 2023).

While blockchain technology offers significant benefits for transparency and trust in Igbo apprenticeship system, it also presents challenges related to privacy and data protection, undermining the trust that is the foundation of the Igbo apprenticeship system. Some mentors may hesitate to teach sensitive parts of the business due to fear of digital betrayal or competition. This makes it easier for apprentices to replicate or leak business ideas or strategies online without permission. Addressing these challenges requires a careful balance between leveraging the advantages of blockchain and ensuring that ethical and legal standards are upheld. Future research and policy development should focus on creating robust frameworks that can guide the adoption and implementation of blockchain in Igbo apprenticeship system, ensuring that its benefits are realized without compromising privacy and data protection.

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Digital Technology and Igbo Apprenticeship

Digital transformation on Igbo Apprenticeship System

Digital transformation and record-keeping, streamline administrative processes, creating a centralized system for storing apprenticeship agreements, progress reports, and other crucial documents, increase accessibility and inclusivity, this can enhance the growth of economy. Online marketplaces and platforms can connect apprentices with potential mentors and customers, expanding their reach and opportunities. Moreover, mobile apps for communication and support which can facilitate communication between apprentices and the master provide access to resources, and offer support networks. By embracing digital transformation, the Igbo Apprenticeship System can evolve into a more effective and sustainable model for entrepreneurship development, contributing to the economic growth and social well-being of the region and the country at large.

Implication: Challenges of Implementation Digital Technologies on Igbo Apprenticeship System

The digital transformation presents many opportunities in the Igbo apprenticeship, but also pose significant challenges to this deeply rooted system which includes:

1. **Disruption of Traditional Learning Structures** – The face-to-face mentorship is central to the Igbo apprenticeship system. Digital technologies may reduce direct interpersonal interactions, weakening the traditional mentor-apprentice bond. Young apprentices may prefer learning via YouTube, online courses, or social media influencers rather than from their assigned mentors.
2. **Erosion of Cultural Values**: The system is deeply embedded in Igbo cultural values such as respect, patience, loyalty and community life. Constant exposure to digital and often Western content may dilute these values among young people. Some digital platforms promote quick wealth and flashy lifestyles, which may conflict with the Igbo apprenticeship system's emphasis on delayed gratification and gradual growth.
3. **Economic Pressure and Changing Aspirations**: Digital technologies often showcase fast routes to success such as crypto trading, content creation etc, making traditional Apprenticeships seem slow or outdated. Young people may abandon the Igbo apprenticeship system for digital "get-rich-quick" paths, increasing dropout rates and reducing trust in the system.
4. **Mitigation and Brain Drain:** The internet exposes young Igbo apprentices to global opportunities. Many may leave their apprenticeship mid-way to pursue tech-based

work abroad or in Nigerian tech-based hubs like Lagos and Abuja. This weakens the continuity and sustainability of the Igbo apprenticeship system.

5. **Increased Competition from E-Commerce and Automation:** Apprenticeship trained in traditional commerce may struggle to compete with tech-savvy entrepreneurs using e-commence platforms like Jumia, Shopify or social media sales. Digital automation such as point-of -sale systems, digital accounting, may reduce the relevance of manual informal business skills traditionally taught in the Igbo apprenticeship system.
6. **Digital Divide:** Many mentors in the Igbo apprenticeship system are not digital literate or equipped to use modern tools, creating a gap between what apprentices learn and what the market demands. This generational technology gap can make mentorship less effective and limit the apprentice's competitiveness in the digital economy.

Case Studies

Case Study 1: AI Improvement in Knowledge acquired in Igbo Apprenticeship System

A case study on the use of AI to improve knowledge acquired form Igbo apprenticeship system a large multinational corporation revealed significant improvements in efficiency and accuracy on the apprentices. The AI system was able to process vast amounts of data quickly, identifying anomalies and enhances teaching and learning process. However, the case also highlighted concerns as relates to job displacement, abandonment of apprenticeship training for get-rich-quick and reducing interest in the system. This system is deeply embedded in the Igbo cultural values and if measures are taken AI can totally eros the Igbo apprenticeship system cultural values. The company addressed this by investing in reskilling programs, helping the masters and the apprentices to transition to new roles that required more analytical and strategic skills (Saleem, et.el 2023).

Case Study 2: Blockchain for Transparency and Trust

Semens AG is a global leader in firm manufacturing, automation and digitalized headquartered in Germany. The company operates in sectors such as energy, healthcare, transportation and industrial production. With operation in over 190 countries, Siemens continually explores innovation technologies to optimize its complex supply chain and production systems. Siemens adopted blockchain technology to address several challenges in its company such as Lack of transparency in mufti-tier supply chains, delays in supplier verification, counterfeit risk in high-value companies and manual efficiencies in logical

involving processes. The firm addressed this by implementing advanced encryption techniques and ensuring that sensitive data was anonymized before being recorded on the blockchain (Bellucci, et.el 2022).

Case Study 3: Digital Technologies on the Small and Medium Enterprise

A SME used digital technologies in analytics to improve its financial decision-making processes. By analysing customer behaviour, market trends, and operational data, the business was able to make more informed decisions, optimize pricing strategies, and enhance supply chain management. However, the increasing penetration of digital technologies across Nigeria and Africa more broadly begun to disrupt the foundational mechanisms of the SME. The business implemented robust data protection measures, including encryption and access controls, and ensured compliance with relevant data protection regulations (Richards & King, 2014).

Discussion of Findings

Synthesis of Insights from Literature and Case Studies

The integration of digital technologies AI and blockchain into Igbo apprenticeship system practices has brought about significant challenges. Synthesizing insights from existing literature and case studies provides a comprehensive understanding of these implications and helps in formulating effective guidelines and best practices.

i. Apprentices and their mentors can expand beyond their local markets through e-commence platforms, social media marketing and online payments. They can now sell products globally via Instagram, WhatsApp Business, Jumia Konga etc. This can lead to reduction in Mentor-apprentice bond, virtual interactions may reduce face-to-face mentorship quality, weakening the emotional and moral development aspect of the apprenticeship.

ii. Digital technologies open up new sectors such as fintech, logistics, digital services etc that apprentices can enter after completing their training thereby, expanding the scope of the Igbo apprenticeship system beyond trade and retail. Apprentices can also supplement their traditional training with online resources like YouTube tutorials, business blogs, e-courses etc. But this can equally rise impatience and shift to fast money, social media often glorifies quick wealth. Many apprentices may abandon the long-term learning in favour of online venture like crypto trading, drop-shipping or scams.

iii. Training and education are crucial for preparation of apprenticeship system (mentors and mentee) to navigate the complexities of technology adoption. Nguyen et al. (2022) emphasize the need for training and education on the implications of disruptive technologies. Training ensures that masters/mentors are aware of potential issues and equipped with the skills to address these challenges.

iv. Digital technologies are reshaping the Igbo apprenticeship system in both empowering and challenging ways. While they provide tools for scaling businesses, improving efficiency and accessing new markets, they also threaten to disrupt traditional structures, cultural values and interpersonal mentorship. The future of the Igbo apprenticeship lies in hybridizing tradition with innovation, integrating digital tools while preserving the core values that have the system successful for generations.

Digital transformation, AI and blockchain can significantly enhance the Igbo apprenticeship system by improving efficiency through digital transformation which streamlines communication between apprentices and their masters, facilitate online learning and improve access to resources. Implementing blockchain technology can create a secure and transparent records of apprenticeship contracts, skill certifications and transactions, ensuring trust and recognition of skills acquired. Digital transformation help improve the credibility of the system, making it easier for apprentices to access opportunities in local and global market in so doing improve economic growth.

CONCLUSION AND RECOMMENDATIONS

Digital technologies offer immense potential, there is need to modernize the Igbo apprenticeship system with digital technologies, by balancing the traditional with the innovation will be key to ensuring the Igbo apprenticeship system remains relevant and effective in the digital age. Based on the synthesis of insights from literature and case studies, the following conclusion and recommendations are proposed to foster wealth redistribution, mentorship and business incubation for adapting digital, AI and blockchain technologies in Igbo apprenticeship system:

The integration of digital transformation, AI and Blockchain into the Igbo Apprenticeship System can preserve the Igbo apprenticeship culture, enhance the efficiency and fairness of the apprenticeship system, increase access to opportunities and ensure its involvement for the 21st-century economy. There is need to ensures that community must led cultural respect, also involve in training and digital literacy initiatives, seeks partnerships with tech firms, NGO and government agencies and must be tested through pilot programs before full-scale

adoption. The transformation of Igbo apprenticeship system will be a powerful way to bridge tradition with innovation, fostering international wealth and sustainable entrepreneurship.

1. **Digitalization of the Apprenticeship Registry:** There is a problem of lack of formal documentation, creating a digital registry or database of apprentices and their masters (Ogas) through web mobile platforms with cloud storage will improve tracking, monitoring and formal recognition.
2. **Mobil Platform for Management and Communication:** Development of a mobile apps tailored for matching apprentices with suitable mentors, communicate goals, performance tracking and feedback, also help the system to access business training resources. Moreover, if Igbo-language version is developed it will enhance user adoption.
3. **AI-Powered Personalization and Learning:** The use of AI-driven chatbots to educate apprentices in Igbo and English on finance, marketing and entrepreneurship. Also, it will mentor apprentices progress and recommend personalized learning or business task.
4. **Blockchain for Smart Contracts and Trust**: The use of blockchain smart contracts in Igbo apprenticeship system will formalise apprenticeship agreements record duration, duties and statement terms. Also, ensure automatic execution and prevent disputes. This will equally bring about transparent in settlement records with its immutability record of an apprentice's service it will prevent exploitation.
5. **Digital Payment and Financial Inclusion:** It will Integrate digital wallets, mobile money or crypto option for sending stipends, settlement of bill and savings for micro-investment. When AI-based credit scoring is adopted, it will help the apprentices to have access to microloans for post-graduation that is the expiration of apprenticeship period.
6. **Data Analytics for Policy and Scaling:** The collection, analysing and reporting of data on the success rate of the Igbo apprenticeship system, the economic outcome and the skills acquired after the process, will be used as an insight to inform government, NGO intervention or investor interest on the policies made in a state or nation.
7. **Collaborations with EdTech and FinTech Startups:** Igbo apprenticeship will partner with EdTech platform this will improve the skill-building of the apprentices. With FinTech it will enhance the system in terms of savings, insurance and fund during settlement, also engages the local entrepreneurs for field integration.
8. **Digital Certification and Recognition:** Introduction of digital certificate at the completion of the apprenticeship system, the apprentices is issued with blockchain-

verified digital certificate. Which will be used to access microloans, secure partnership and prove credibility in the wider business world.

9. **Cultural Preservation and Digital Storytelling:** The use of multimedia platform in Igbo apprenticeship to document success stories and share knowledge acquired in the system and equally help preserve and modernize Igbo values while educating the new generations.

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