

The Place of Industrial Technology Education in an Era of Uncertainties in Nigeria

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Abstract

Industrial Technology Education (ITE) is crucial in addressing the challenges posed by Nigeria's uncertain socio-economic and technological landscape. In an era marked by rapid technological advancements, unemployment, policy instability, and economic fluctuations, ITE offers a pathway to equipping the workforce with practical, industry-relevant skills. This paper critically examine the key role ITE plays in preparing individuals for the technological demands of industries, especially with the rise of automation, robotics, and digitalization. It opined that ITE provides training in essential technical skills, fosters innovation, and prepares students to adapt to new technologies. By emphasizing hands-on learning, ITE enhances employability and reduces the skills mismatch that contributes to unemployment in Nigeria. However, this is not without some challenges of underfunding, shortage of manpower and outdated curriculum. Consequently, government support, through policies, funding, and public-private partnerships, is critical to the success of ITE. Effective policies can align education with national development goals, while investment in infrastructure and instructor training ensures that institutions can deliver modern and relevant education.

Keywords: Education, Era, Industrial, Technology, Uncertainties

Introduction

Industrial Technology Education (ITE) plays a crucial role in equipping individuals with the necessary skills for technical innovation, workforce readiness, and national development. In Nigeria, an era marked by uncertainties such as economic fluctuations, political instability, and rapid technological advancements presents unique challenges and opportunities for the integration of ITE. This type of education is aimed to bridge the gap between theoretical knowledge and hands-on, technical competencies in a range of industries, from construction to automotive, electronics, and energy sectors. According to Tolu, (2021) the curriculum often includes subjects such as engineering, automation, manufacturing processes, electrical and mechanical systems, and applied sciences. ITE integrates both theoretical knowledge and practical skills across a wide spectrum of technological disciplines

focusing primarily on technical Skills Development, engineering and applied Sciences, management and Operations, automation and Control Systems.

Nigeria faces numerous uncertainties that affect its policy, economic, and social landscape. These uncertainties are interconnected, with policy failures often exacerbating economic and social challenges, while economic instability and social unrest, in turn, complicate policymaking Ajibola, (2020). These uncertainties create a complex environment that hampers national development. inconsistent and poorly implemented policies, economic challenges such as over-reliance on oil, inflation, and rising debt, combined with social tensions related to poverty, inequality, and insecurity, hence, a vicious cycle of instability is created. Industrial Technology Education aimed at preparing individuals for various technical and industrial roles will equipped individuals with the practical skills and theoretical knowledge required to support industrial growth, innovation, and economic development that will re-direct Nigeria economic and social challenges (Akpan, 2020). Dike (2017) and Akpan (2020) stated that ITE has the capacity to provide technical skills development, workforce development, economic development, technological advancement, problem solving and innovative skills to individual's learners thereby providing answers to Nigeria economic woes.

Historical Context of Industrial Technology Education in Nigeria

Industrial Technology Education evolved from vocational and technical education systems designed to meet the workforce needs of the industrial revolution. ITE in Nigeria has its roots in colonial education, where emphasis was placed on producing clerical and administrative personnel, neglecting technical education. Post-independence, Nigeria made efforts to reform the educational system to meet the needs of its industrial sector, introducing technical education into secondary and tertiary curricula. ITE gained prominence during the post-independence era as the country sought to develop a skilled workforce to support its growing industrial base (Eze, 2021). Over the years, it has adapted to include emerging technologies such as automation, digitalization, and renewable energy, reflecting the changing demands of modern industries.

According to Okoro, (2018); Ubah, (2019) and Eze, (2021) ITE primarily focuses on technical skills development where students learn skills like welding, machining, electrical work, and computer-aided design (CAD). These skills are essential for roles in industries like manufacturing and construction; engineering and applied sciences here ITE incorporates elements of engineering, physics, and material sciences, providing students with foundational knowledge for solving technical problems. On management and operations ITE introduces individual learners into the management of industrial systems, teaching students how to optimize production processes, maintain equipment, and oversee technological systems in industrial settings. On automation and control systems, the learner is equipped with the growing

integration of automation in industries, focusing on training students to operate and manage automated systems, robotics, and programmable logic controllers (PLCs). However, historical underfunding and mismanagement over the years hindered the growth of this sector. Despite these challenges, Nigeria has established various technical colleges and universities to promote technological skills acquisition (Ubah, 2019).

The Importance of ITE in National Development

In an era marked by uncertainties, ITE is pivotal for national development. It equips individuals with practical skills needed for employment in industries such as manufacturing, construction, and engineering. These skills contribute to industrial growth and technological innovation, which are critical for Nigeria's economic diversification. The reliance on oil exports has left the Nigerian economy vulnerable to global price fluctuations, making the development of the industrial sector crucial for economic stability (Giwa, 2020). Thus, ITE provides a pathway for reducing dependence on oil by fostering a workforce capable of driving growth in various sectors. Through; workforce development, economic development, technological advancement, problem-solving and innovation. ITE is crucial for workforce development by producing skilled labor necessary for industrial growth and addresses the need for technicians, engineers, and other technical professionals in industries like manufacturing, construction, and energy. On economic development ITE can fostered a skilled workforce, contribution to economic development, particularly in countries that aim to diversify their economies through industrialization (Akpan, 2020). ITE also drive the economy through technological advancement by equipping individuals with the technical knowledge to manage, innovate, and implement industrial technologies, which is essential for national competitiveness in a globalized economy (Dike, 2017). ITE through hands-on experiences and critical thinking, enable the students to learn how to troubleshoot technical issues and innovate in the workplace, promoting productivity and efficiency in industrial sectors through problem-solving and innovation.

Addressing Unemployment through ITE

Youth unemployment is one of the most pressing issues in Nigeria, with millions of young people lacking job opportunities. ITE offers a potential solution by providing students with skills that are directly applicable in the workforce. The practical nature of ITE programmes enable graduates to engage in self-employment, entrepreneurship, or gain employment in industries. For instance, the automotive and manufacturing sectors require skilled technicians, welders, and technologists, all of whom can be trained through ITE programmes. Moreover, the informal sector in Nigeria, which includes various industrial activities, could benefit from a workforce trained in industrial technology. By improving the quality and availability of technical training, Nigeria could see a reduction in unemployment rates and a more dynamic economy.

Industrial Technology Education (ITE) offers a potential solution to Nigeria's persistent unemployment problem, particularly among its youth. By equipping individuals with practical, industry-relevant skills, ITE can bridge the gap between education and employment, fostering a workforce that can meet the demands of various industries. ITE is designed to equip students with technical skills that are directly applicable in various industries, such as manufacturing, construction, automotive, and information technology. By providing hands-on experience in fields like welding, electrical engineering, mechanical systems, and digital technologies, ITE programs prepare graduates for employment in sectors that are in need of skilled labor by addressing skills mismatch, self-employment and entrepreneurship among individuals (Dike, 2017). One of the key drivers of unemployment in Nigeria is the mismatch between the skills taught in traditional education systems and those required by the labor market. Many graduates lack the technical and vocational skills necessary for employment in industries, leading to high unemployment rates despite the availability of job openings in technical fields. ITE can fill this gap by offering industry-relevant training that makes graduates more employable (Giwa, 2021).

ITE also provides the foundation for self-employment and entrepreneurship, especially in sectors like manufacturing, repair, and construction. By teaching practical skills, ITE allows graduates to start their own businesses or work as independent contractors, thereby reducing reliance on formal employment. This is particularly important in Nigeria, where the formal sector cannot absorb the large number of job seekers entering the labor market every year (Aina, 2020)

Furthermore, ITE supporting economic diversification, Olawale (2020) and Uche (2022) opined Nigeria's economy has historically relied on oil, but the volatility of global oil prices has highlighted the need for diversification. ITE plays a crucial role in supporting economic diversification by producing a skilled workforce capable of driving growth in non-oil sectors such as manufacturing, agriculture, and technology through strengthening the manufacturing sector, boosting the agriculture and agro-processing sectors. Olawale (2020) observed that Nigeria's manufacturing sector has the potential to generate significant employment, but it suffers from a lack of skilled labor. ITE programs that focus on areas like industrial production, automation, and engineering can supply the manufacturing sector with the technical workforce it needs to expand and become more competitive globally.

Uche (2022) states that agriculture remains a significant employer in Nigeria, but it is largely characterized by low productivity. ITE can enhance agricultural productivity by training workers in the use of modern agricultural machinery, food processing technologies, and sustainable farming techniques. This can create jobs across the agricultural value chain, from production to processing and distribution. However, according to Okoye (2019) ITE effectiveness in addressing unemployment is contingent on several factors, including the

alignment of curricula with industry needs, the quality of training provided, and the overall economic environment in which these skills are deployed. With right investments and policy reforms, ITE can be a critical tool in reducing Nigeria's unemployment and driving long-term economic growth

The Role of ITE in Addressing Technological Changes

Industrial Technical Education (ITE) plays a crucial role in equipping the workforce with the skills and knowledge necessary to navigate and thrive in technologically evolving industrial environments. This section discusses the key roles ITE performs in addressing technological changes under distinct subheadings.

Training in Automation and Robotics

As industries increasingly adopt automation, the demand for workers who can operate and maintain these systems has risen sharply. ITE programs focus on equipping workers with technical proficiency in automation and robotics, ensuring they can manage complex industrial systems. According to Hassan (2020), ITE provides hands-on training in robotics, programmable logic controllers (PLCs), and automated systems, which enables workers to program and troubleshoot systems in real-time. For example, manufacturing processes heavily rely on automated systems, and downtime is costly. ITE plays a pivotal role in reducing this downtime by training workers to efficiently address malfunctions, thus enhancing productivity.

Emphasis on Digital Literacy and IT Skills

With the rise of digital technologies across industrial operations, digital literacy has become a fundamental skill. Femi (2021) argues that industries now demand workers who can manage software for design, simulation, and operational control. ITE integrates training in areas such as computer-aided design (CAD), data analytics, and information technology (IT) systems into its curriculum, ensuring that workers are equipped to handle digital processes central to modern industrial systems. These skills are essential for managing automated production lines, optimizing processes, and ensuring that digital tools are seamlessly integrated into daily operations.

Adaptability to New Technologies

One of the most important roles ITE plays is fostering adaptability among workers. As technological changes are frequent, industries require workers who can quickly learn and apply new technologies. Ibrahim (2019) highlights that ITE teaches problem-solving, critical thinking, and continuous learning, which are vital for adapting to emerging technologies and new production techniques. This adaptability ensures that workers remain valuable to industries even as technologies evolve, allowing companies to stay competitive in a rapidly changing market.

Fostering Innovation through Research and Development (R&D) Skills

Beyond adapting to current technologies, ITE also contributes to innovation by equipping workers with Research and Development (R&D) skills. A well-trained workforce can lead industrial advancements by contributing to the development of new technologies or refining existing ones. Bello (2021) notes that ITE programs encourage workers to engage in R&D, leading to innovations in product design, process efficiency, and the development of new machinery. For instance, engineers and technicians trained in R&D can design more efficient manufacturing equipment or create sustainable processes, which drives technological advancements across industries.

Supporting Emerging Industries and Technologies

As new industries emerge, such as renewable energy, biotechnology, and artificial intelligence, ITE evolves to meet the workforce needs of these sectors. The transition to renewable energy sources, in particular, has created a demand for workers skilled in the installation, maintenance, and optimization of green technologies. Okoro (2021) observed that ITE programs focusing on renewable energy equip students with the skills needed to install solar panels, maintain wind energy systems, and manage energy storage technologies. By preparing workers for roles in renewable energy and other advanced sectors, ITE ensures that industries can adopt new, sustainable practices.

Preparing the Workforce for Biotechnology and Advanced Manufacturing

In highly specialized sectors like biotechnology and advanced manufacturing, workers need cutting-edge technical skills. Adekunle (2020) notes that ITE programs integrate subjects like molecular biology, nanotechnology, and precision manufacturing to prepare a workforce capable of supporting these evolving industries. With this training, workers can contribute to innovations in fields such as genetic engineering, nano-manufacturing, and precision-based industrial processes, which are at the forefront of modern technological change. Industrial Technical Education (ITE) plays an indispensable role in addressing technological changes by training workers in automation, enhancing digital literacy, fostering adaptability, encouraging innovation through R&D, and preparing them for emerging industries. This holistic approach ensures that industries have a workforce capable of not only maintaining existing technologies but also driving advancements that will shape the future of industry.

Challenges Facing ITE in Nigeria

The challenges facing Industrial Technical Education (ITE) in Nigeria can be itemized and fully explained as follows, using the same citations:

Inadequate Funding: One of the major challenges confronting ITE in Nigeria is inadequate funding. Without sufficient financial resources, technical institutions are unable to acquire the modern tools and equipment needed to train students effectively in current

industrial practices. As a result, these institutions cannot offer quality technical education that aligns with the technological advancements in industries. This funding gap affects both the infrastructure and the overall quality of education (Tolu, 2021).

Poor Infrastructure: Many ITE institutions in Nigeria lack the proper infrastructure to support effective learning. Outdated and insufficient facilities limit the ability of students to engage in hands-on, practical training. This shortage of up-to-date equipment hinders the development of relevant technical skills, leaving students underprepared for real-world industrial environments (Tolu, 2021). The poor state of infrastructure also affects the ability of institutions to keep up with technological changes.

Outdated Equipment: The use of outdated equipment is a critical challenge in Nigerian ITE programs. Students are often trained with obsolete tools that do not reflect the modern machinery and technologies used in industries today. This gap in technological resources means that students may lack the practical skills necessary for the current job market, contributing to a mismatch between educational outcomes and industry expectations (Tolu, 2021).

Emphasis on Theoretical Learning Over Practical Training: Many ITE programs in Nigeria place a disproportionate emphasis on theoretical knowledge rather than practical skills. This imbalance limits the effectiveness of the education provided, as students are not given enough opportunities to apply their theoretical understanding in real-world contexts. As industries increasingly seek workers with hands-on experience, this focus on theory rather than practice further widens the gap between graduates' skills and industry needs (Tolu, 2021).

Lack of Access to Modern Equipment and Training Facilities: To keep pace with technological changes, ITE institutions need access to modern equipment and up-to-date training facilities. However, many institutions lack the financial and logistical resources to acquire these necessary tools. The inability to provide students with training on current technologies creates a gap between the skills taught in schools and those required in the workforce. This challenge is particularly critical for industries that rely on advanced technical systems (Tolu, 2021).

Mismatch Between ITE Curricula and Industry Needs: A significant challenge in Nigerian ITE is the disconnect between the curricula taught in institutions and the actual needs of employers. Ogunleye (2020) highlights that many ITE programs are based on outdated curricula that do not reflect the latest technological advancements in industries. This mismatch leads to graduates who are ill-prepared for the workforce, as the skills they acquire in school may be obsolete or irrelevant to current industry demands. Consequently, this contributes to high levels of unemployment among ITE graduates.

Outdated Curricula: The lack of continuous updates to ITE curricula is another critical issue. As industries evolve and new technologies emerge, it is essential that ITE programs regularly update their course content to reflect these changes. Ogunleye (2020) notes that many programs in Nigeria fail to revise their curricula, meaning students are often trained in outdated technologies. This hinders graduates' employability and reduces their ability to contribute effectively to modern industries.

Shortage of Qualified Instructors: Another major challenge is the shortage of qualified instructors in ITE institutions. Farouk (2022) observed that many technical education institutions struggle to attract and retain instructors who have the advanced technical knowledge needed to teach cutting-edge technologies. The lack of skilled instructors means students may not receive adequate training in modern industrial processes, further exacerbating the gap between education and industry demands.

Lack of Continuous Training for Instructors: The rapid pace of technological change necessitates continuous training for instructors to ensure they remain updated on the latest advancements in their fields. However, many ITE institutions in Nigeria do not provide sufficient professional development opportunities for their teaching staff. Without continuous training, instructors may struggle to teach emerging technologies effectively, further reducing the quality of education provided to students (Farouk, 2022).

Policy and Government Support for ITE

The success of Industrial Technology Education (ITE) in preparing a skilled workforce capable of meeting modern industrial demands is significantly influenced by government policies and support. Governments play a pivotal role in shaping ITE programs through policy formulation, funding, and partnerships with industry stakeholders. In Nigeria, as in many developing countries, government support is essential to overcoming challenges such as outdated curricula, inadequate infrastructure, and a lack of skilled instructors. A robust policy framework is fundamental to the successful implementation and growth of ITE. Government policies must define clear objectives for technical and vocational education, ensuring that it aligns with the country's industrial and economic needs. The National Policy on Education outlines the importance of technical and vocational education as a tool for national development. This policy mandates the establishment of technical colleges and vocational schools aimed at developing skilled labor for the country's industrial sectors. It also emphasizes the need for practical training, partnerships with industries, and continuous curriculum updates to reflect technological changes (NPE, 2018).

Government agencies, such as the National Board for Technical Education (NBTE) in Nigeria, are responsible for developing standardized curricula for technical institutions. These

agencies ensure that ITE programs meet national standards and provide students with skills that are relevant to the labor market. According to NBTE (2021) well-structured curriculum that includes the latest technological advancements ensures that graduates are equipped with up-to-date skills. Industrial technology education is recognized as a critical factor in achieving this goal by developing a skilled workforce that can drive industrialization, innovation, and economic growth.

Government investment in infrastructure, equipment, and human resources ensures that ITE institutions can provide high-quality education that meets industry standards. According to Uche (2021) one of the key challenges facing ITE in Nigeria is the inadequate infrastructure in technical colleges and vocational schools. Government funding is required to build new institutions, upgrade existing facilities, and ensure that training equipment is modern and industry-relevant. Without proper investment, ITE programs cannot offer practical, hands-on training that meets the needs of modern industries.

Bello (2020) opined that the government can provide scholarships or tuition subsidies for students pursuing technical and vocational education. This is particularly important in countries like Nigeria, where many students cannot afford the cost of education. Financial support from the government can make ITE more accessible and attractive to a broader range of students. A significant portion of government funding should be directed toward the training and continuous professional development of instructors. As industries evolve, so too must the skills of those teaching ITE programs. Governments should invest in capacity-building initiatives, including workshops, certifications, and international collaborations, to ensure that instructors are familiar with the latest technologies and teaching methodologies (Farouk, 2022).

Global Competitiveness and the Future of ITE

In a globalized world where industries must compete on the basis of efficiency, quality, and technological innovation, ITE plays a crucial role in maintaining the competitiveness of national industries. By training workers to use modern technologies, ITE ensures that industries remain efficient, productive, and capable of competing internationally by improving efficiency and productivity and ensuring global competitiveness. Olawale (2020) states that technologically trained workers are better able to optimize industrial processes, reduce waste, and improve product quality. For instance, ITE graduates working in manufacturing can apply lean manufacturing techniques, automation, and real-time data analysis to streamline production processes and reduce costs. This, in turn, makes industries more competitive by enabling them to produce high-quality products at lower costs. In an era of technological advancements, countries that fail to invest in ITE risk falling behind in global markets. Industries in countries with a skilled, technologically adept workforce can adopt and implement

new technologies more quickly, giving them an edge over competitors. According to Nwosu (2022) ITE provides the foundational knowledge necessary for industries to adopt cutting-edge technologies like artificial intelligence, additive manufacturing (3D printing), and the Internet of Things (IoT).

For Nigeria to remain competitive in a globalized world, its workforce must possess skills that meet international standards. ITE offers a pathway to achieving this by providing the technical expertise required for industrial growth and technological innovation. However, without significant reforms in the educational system, Nigeria risks falling behind other nations in terms of industrial capacity and technological advancement. To future-proof ITE in Nigeria, there is a need for continuous curriculum updates, investment in modern technology, and the training of instructors. Furthermore, the government must increase funding for technical education and ensure that policies are effectively implemented.

Conclusion

Industrial Technology Education holds immense potential in addressing many of Nigeria's current challenges, including unemployment, economic instability, and technological changes. However, for ITE to fulfill this potential, significant reforms are required. These include addressing funding shortages, improving infrastructure, aligning curricula with industry needs, and fostering stronger partnerships between educational institutions and industries. In an era of uncertainties, ITE could serve as a cornerstone for national development, equipping Nigeria with the skilled workforce needed to thrive in a rapidly changing world.

Way forward

1. The Federal Government of Nigeria should consider improved support, through policies, funding to ITE, and also provide policies that will encourage public-private partnerships to ITE,
2. Investment in infrastructure and instructor training by government is an imperative as this will ensure that institutions can deliver modern and relevant education.
3. Issue of outdated curricula must be addressed for ITE to fully realize its potential.

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