

Fine-Tuning The Nigerian Oil And Gas Technology Development Framework For The Digital Age

By

Musa Kalam Abdulkadir*

Abstract

This article contends that rapid digital transformation has rendered the Nigerian petroleum technology development framework outdated. This misalignment is adversely affecting the provision of digital technology services under the local content development regime. As a remedial measure, the article proposes a re-orientation in the approach to engaging with the Nigerian Oil and Gas Industry Content Development (NOGID) Act and the Petroleum Technology Development Fund (PTDF) Act. This re-orientation aims to quickly consolidate and align the provisions of these statutory frameworks with the current realities of the digital age. The article begins by mapping the state of digital technology in the Nigerian oil and gas industry, highlighting the global digital transformation trend and its impact on digital oil and gas technology. It discusses the efficiencies and benefits introduced by advanced digital technology solutions, such as improved health and safety, increased marginal operational efficiencies, and optimized oil production. The article also examines the low level of Nigerian content in digital technology services and the lack of regulatory emphasis on developing indigenous capacity in this area.

Furthermore, the article explores the general tenor of the Nigerian local content development policy framework and takes stock of how specific provisions have impacted the implementation of the NOGID Act, particularly in relation to digital technology service provision. It also tackles salient aspects of the PTDF Act and how digital technology has fared under the law's framework. The article concludes by setting an itemized agenda for the future of digital oil and gas technology services development in Nigeria. It emphasizes the need for a comprehensive digital technology roadmap, the establishment of a dedicated Digital Technology Directorate within the NCDMB, and the introduction of PTDF professorial chair endowments specifically for digital petroleum technology in major Nigerian universities. The article also calls for the reinstatement of the NOGTECH Hackathon as an annual event and the creation of incentives for joint ventures between international digital technology service providers and Nigerian firms.

Keywords: Petroleum technology, Digital oil and gas technology, Oil and gas law, Nigerian local content development law, Petroleum technology development fund

1. Introduction

Advanced digital technology solutions are now the trend across all industries including oil and gas. Digital technology solutions are being leveraged “to better understand reservoir resources and their production capacity, improve health and safety, and increase marginal operational efficiencies in oil fields.”¹ Their current application has been taken to a heightened level by the exponential growth in data collection and processing capabilities, and the computational power for optimum

*National Information Technology Development Fund (NITDEF) Cyber Law Scholar (2020/2021). His research interests encompass the general intersection of law and information technology. E-mail: mskalaam88@gmail.com

¹ Haouel, C. & Nemeslaki, A. “Digital Transformation in Oil and Gas Industry Opportunities and Challenges” *Periodica Polytechnica Social and Management Sciences* (2023) DOI:10.3311/PPso.20830.

data analyses and sharing.² The trend marks a move away from conventional methodologies that involve manual data gathering, analysis, and decisions based on error-prone expert knowledge.³ Data from different oil and gas operations are collected and analyzed to gain insights into equipment health and predict their failure, to reduce risks and enhance the safety of operators, to maximize oil recovery, to increase the lifespan of oil fields, and so on.⁴ Digital tools are configured to intelligently go through vast amounts of data and execute important, repetitive tasks, thereby freeing engineers to focus on higher-value activities.⁵ All these eventually lead to optimized oil production, reduced costs as well as lowered carbon emission levels⁶.

In the Nigerian industry, these essential oil and gas services are still overwhelmingly provided by foreign technology services companies. A 2011 survey by Oyejide & Adewuyi found that

the degree of local sourcing of inputs (by local suppliers or servicing firms) in the Control system and ICT sub-sector is less than what obtains in the other sub-sectors. ... Most servicing firms are national, but the control system and ICT sub-sector has the highest multinational presence.⁷

Five years later, in 2016, there was only a 2.1 percent Nigerian capacity in the area. This is a shaft contrast with the 19.6 percent, 8.1 percent, 7.7 percent and 5.2 percent inputs recorded in exploration and production, design and engineering, fabrication and construction, drilling and well completion components, respectively.⁸ This very low level of Nigerian content in digital technology services is unhealthy and inimical to the country's local content development drive. This is more so in light of the criticality of advanced digital technology solutions in the current oil and gas landscape. One main reason for this is the lack of regulatory emphasis on the development of indigenous capacity in digital technology service provision. It is high time that necessary attention is brought to bear on the technology segment, and this paper is a pioneering contribution in that direction.

Section I starts off the paper with a mapping of the state of digital technology in the Nigerian oil and gas industry, the global digital transformation trend, its impact on digital oil and gas technology and the efficiencies and benefits introduced. The section also offers a conceptual clarification of the nuances between **petroleum**/oil and gas technology and **digital petroleum**/oil and gas technology. Section II discusses the general tenor of the Nigerian local content development policy framework. Section III takes stock of how some specific provisions have

² *Ibid.*

³ Zahn, D. "What Global Pandemic Responses Teach Us in Upstream O&G". <https://www.ambyint.com/resource-item/what-global-pandemic-responses-teach-us-in-upstream-og/> (accessed January 2, 2023).

⁴ Asarpota, J. "Technology Focus: Digital Data Acquisition" *Journal of Petroleum Technology* (2024) 76 (01): 86–87.

⁵ Zahn, *Supra* note 3.

⁶ Lakshmipathi, K., Shel, H. & Shah, J., (2023) "Rethinking Energy with Generative AI" *Amazon Web Services* <https://aws.amazon.com/blogs/industries/rethinking-energy-with-generative-ai/> (accessed 10 February 2023).

⁷ Oyejide, T.A. and Adewuyi, A.A. "Enhancing linkages of oil and gas industry in the Nigerian economy" MMCP Discussion Paper No 8, University of Cape Town and Open University, (March 2011) p (iii).

⁸ Adedeji, A. "The Role of Local Content Policy in Local Value Creation in Nigeria Oil Industry: A Structural Equation Modeling (SEM) Approach" *Resource Policy Journal* (2016) 49, 61-73. p 65.

impacted the implementation of the Nigerian Oil and Gas Industry Content Development (NOGID) Act and the pitfalls on digital technology service provision. Section IV tackles some salient aspects of the Petroleum Technology Development Fund Act and how digital technology as a form of technology fared under the law's framework. Section V wraps up the article and sets an itemized agenda for the future of digital oil and gas technology services development in Nigeria.

1.1 Petroleum Technology versus Digital Petroleum Technology

‘Technology’ in the petroleum industry has broadly been construed as the “systematic application of knowledge to practical tasks, for the exploration and exploitation of oil and gas, and for the rendering of services in the industry.”⁹ The petroleum technology development framework in Nigeria, however, stood on a very narrow conception of the term. The Nigerian framework generally envisages technology as the use of “purpose-built machines designed to perform a limited scope of functions”.¹⁰ It revolves around the understanding of technology as “products, services and tools that are primarily physical”, or whose value lies in “physical functionality”.¹¹ This, consequently, resulted in lopsided emphasis on aspects such as manufacturing, construction and fabrication of physical structures, tools and machinery.

Even in the global oil and gas industry, ‘technology’ has until quite recently connoted ‘operational’ technology,¹² “the use of proprietary software and hardware to manage and control mechanical, electronic, and other devices in the physical world.” Notable examples here include industrial control systems such as programmable logic controllers (PLCs) and Supervisory Control and Data Acquisition (SCADA) systems. PLC is a type of hardware that follows “a set of rules and logic to perform a preprogrammed task”, usually in the automation of industrial processes. Closely connected but at a slightly higher level of functionality is the SCADA, which is also used in industrial automation. The SCADA system consists of a server and a network of data-collecting sensors that are connected to motors, pumps and other tools in distributed locations, enabling them to be remotely controlled by office-based operators.

The above conception largely sidelines the understanding of technology as ‘information technology’, the use of “general-purpose computing machines that could be programmed for various tasks”.¹³ It also largely fails to appreciate technology as ‘digital technology’, the use of digital “devices, systems, and resources that help create, store, and manage data.”¹⁴ Information

⁹ Kassim-Momodu, M. “Transfer of Technology in the Petroleum Industry: the Nigerian Experience” *Journal of World Trade* (August 1988) Vol. 22 No. 4, p 51.

¹⁰ <https://www.studysmarter.co.uk/explanations/business-studies/business-development/digital-technology/> (accessed 10 February 2023).

¹¹ Spacey, J. “50 Examples of Physical Technology” *Simplicable* <https://simplicable.com/technology/physical-technology> (accessed 10 Feb 2023).

¹² Castagna, R. “Operational technology vs. information technology explained” (May 6, 2024) <https://www.techtarget.com/iotagenda/tip/Operational-technology-vs-information-technology-explained> (accessed November 7, 2024).

¹³ <https://www.studysmarter.co.uk/explanations/business-studies/business-development/digital-technology/> (accessed 10 February 2023).

¹⁴ Study Smarter, “Digital Technology: Definition, Examples & Impact” <https://www.studysmarter.co.uk/explanations/business-studies/business-development/digital-technology/#:~:text=The%20definition%20of%20digital%20technology,to%20process%20data%20and%20information> (accessed 22 November 2024).

technology stands at the core of digital technology, enabling “the use of computers to process data and information.” While digital devices and systems collect and store data, information technology deploys computational power and skills to harness the data. As opposed to the traditional understanding of technology, which is more concerned with physical and mechanical functions, digital technology is more concerned with intelligent harnessing of data by intelligent systems. As opposed to the use of preprogrammed software, data is now harnessed to provide a dynamic logic by which physical products and services are run or directed.

Digital petroleum technology generally encompasses leveraging the power of data in the management of operational and technical processes at the oilfield,¹⁵ the harnessing of digital data to enhance decision-making and unlock massive operational efficiencies. Data and its “interpretation is now seen as a potential profit-making machine for oil majors that need to sift through billions of data sets a day to make everyday operation and long-term investment decisions more accurate.”¹⁶ The digital oil field (DOF), for example, is an intelligent configuration in which different components of the oilfield ecosystem are digitally connected, visually monitored and remotely controlled in real time by leveraging high quality digital data. Data collected from geophysical and geological activities, data from well and production operations, data from reservoirs, rigs, wells and other field facilities are collected in a central platform and then subjected to machine learning techniques to build models which support decision making,¹⁷ optimize oil production, cut costs, decrease operational footprints and increase overall efficiency.¹⁸

Research by the International Energy Agency (IEA) revealed that the use of digital technology solutions in oil and gas operations could reduce production costs by up to 20 percent while increasing the rate of oil recovery from existing reserves by about 5 billion barrels.¹⁹ By using digital tools in its artificial lift solutions, Equinor oil company was able to increase the performance of under-pumping wells by 33 percent and general pump efficiency by 14 percent.²⁰ Apart from the huge potentials for increase in reliability, sustainability and predictability of energy supply, digital technology has carbon reduction potentials. While achieving a 10-45 percent production boost with a single treatment, Locus Bio-Energy’s enhanced oil recovery solution, AssurEOR STIM, managed to reduce the carbon intensity by 7-20 percent.²¹ Digitalization, when early

¹⁵ *Ibid.*

¹⁶ Luck, M. “Backed by Big Oil, tech startup launches new partnership with Microsoft” (2019) *Houston Chronicle*.

¹⁷ Ike, D.U., Anthony, A., Abdulkareem, A. “Impact of ICT in Oil and Gas Exploration: A Case Study” *Int. Journal of Computers & Technology* (2013) Vol 10 No.7 1830 - 1935, p 1831.

¹⁸ Oil Review Africa, “Schlumberger and Cognite Will Provide Integrated Data to Optimise Production” (September 15, 2022).

<https://oilreviewafrica.com/technology/technology/schlumberger-and-cognite-will-provide-integrated-data-to-optimise-production> (accessed November 20, 2024).

¹⁹ *Ibid* at 2.

²⁰ Ambyint, “SPE ALCE: Pushing The Limits of Artificial Lift”

<https://www.ambyint.com/resource-item/recap-spe-alce-pushing-the-limits-of-artificial-lift/> (accessed 10 February 2023).

²¹ “New Technology that Reduces Carbon Intensity of Production Receives SGS Certification” (2023)

<https://oilreviewafrica.com/technology/technology/new-technology-that-reduces-carbon-intensity-of-production-receives-sgs-certification#:~:text=New%20technology%20that%20reduces%20carbon%20intensity%20of%20production%20receives%20SGS%20certification,->

integrated with electrification technologies to enable autonomous oil and gas operations, can help reduce “over 300,000 tons of carbon emissions per annum for offshore sites (approximately 25 percent reduction).” This is equivalent to “removing 150,000 combustion cars from the road and is the same volume of CO₂ responsible for five million tons of glacier mass lost each year.”²²

The particularly conservative understanding taken to ‘technology’ in the Nigerian oil and gas industry has unarguably run its beneficial course. Indeed, the approach has guided impactful efforts by relevant agencies such as the NCDMB, and intervention initiatives such as those under the petroleum technology development fund. However, in light of recent developments, it is high time that the approach be expanded to include and highlight digital technology that is now at the center of the digital revolution and sweeping through all industries with massive efficiency and increase in productivity. The natural starting point for this reorientation is a new and conscious engagement with the central oil and gas technology laws and frameworks.

2. The Nigerian Oil and Gas Local Content Policy Framework

The oil and gas industry ranks as one of the particularly technology-intensive industries. Optimal operation, safety and profitability in the industry relies on cutting edge, constantly updated technology toolboxes. However, Nigeria, like many other oil-rich global south countries, lacks these toolboxes, a lack that is greatly hampering their productivity and profitable ownership of the industry value chains. To address this nagging problem, countries resort to local content development policies to enhance the benefits accruing to their economies from the exploitation of their natural resources mainly by foreign companies who channel profits from their operations to their home countries. One stellar example of the many countries that have a great deal of benefit to show from this approach is Norway. Through a dedicated and focused local content development framework, Norway has since moved from a rent-taking economy to a competent exploiter of oil and gas resources and expertise, having ridden on the back of its local content vehicle to develop a world standard national oil company, the Statoil, as well as supported dozens of privately owned oil companies.²³

The Norwegian model was built on three fundamental pillars, namely state participation, local content requirements, and technology transfer mechanisms.²⁴ What distinguishes Norway's approach is its early recognition of technology development as a crucial component of local content policy. The Norwegian technology agreements of the 1970s mandated international oil companies to conduct a good percentage of their research and development activities in collaboration with Norwegian institutions.²⁵ This policy created a robust ecosystem where digital

[Created%3A%2015%20November&text=The%20novel%20AssurEOR%20STIM%20biosurfactant,wells%20across%20top%20oil%20basins](#) (accessed 1 March 2023).

²² ABB, “300,000 tons in carbon emissions to be saved by autonomous oil and gas operations” (November 1, 2022) [https://new.abb.com/news/detail/96392/300000-tons-in-carbon-emissions-to-be-saved-by-autonomous-oil-and-gas-operations#:~:text=Based%20on%20nine%20months%20of,offshore%20sites%20\(approximately%2025%20percent](https://new.abb.com/news/detail/96392/300000-tons-in-carbon-emissions-to-be-saved-by-autonomous-oil-and-gas-operations#:~:text=Based%20on%20nine%20months%20of,offshore%20sites%20(approximately%2025%20percent) (accessed November 22, 2024).

²³ Ryggvik, H. “A Short History of the Norwegian Oil Industry: From Protected National Champions to Internationally Competitive Multinationals” *Business History Review* 89 (Spring 2015) pp 3 - 41.

²⁴ See generally Vorobyov, A. “Research and technology agreements in the Norwegian concession system of the 1970s - 1990s” *Baltic Region* (2012) No. 4, pp 43-51. <https://doi.org/10.5922/2079-8555-2012-4-5>

²⁵ Grønhaug, K, "Knowledge transfer: The case of the Norwegian technology agreements" *Elsevier* (1989) vol. 17(3), pp 273-279.

technologies could flourish. With respect to digital technology, local content development received a great fillip from indigenous efforts such as the establishment of research centers like SINTEF and the Norwegian Computing Center. These fostered an environment where local expertise could develop cutting-edge digital solutions for industry.

In Brazil, Petrobras helped accelerate digital oil and gas transformation by providing a successful model of state-led digital innovation program. Through its CENPES research center, Brazil has developed world-class digital technologies for deepwater exploration and production. Targeted digital technology programs include the creation of technology parks focused on digital innovation, partnership with universities for digital skills development, implementation of advanced digital twin technology for offshore operations, development of AI-driven exploration tools, etc. Malaysia has also successfully implemented a comprehensive digital blueprint for upstream operations, rolled out cloud-based integrated operations centers, deployed advanced analytics for production optimization and implemented several digital workforce development programs.²⁶ The national oil company PETRONAS even has a dedicated digital arm, the PETRONAS Digital, which is currently working “to accelerate data and AI initiatives that helps to advance innovation and improve productivity. PETRONAS Digital is “commitment to use data securely and responsibly to drive organizational decision-making.”²⁷

The foregoing successful experiments in local content development offer compelling case studies for Nigeria's local content development aspirations in the area of digital oil and gas technology services.

2.1 Nigerian Oil and Gas Industry Content Development Act

Nigeria enacted its oil and gas industry local content law in 2010, the culmination of a series of legislations, regulations and policies put in place by successive governments to increase the benefits accruing to the nation's oil and gas resources. The central goal of the law is to increase the “composite value added to or created in the Nigerian economy by a systematic development of capacity and capabilities through the deliberate utilization of Nigerian human and material resources and services.”²⁸ This grand objective is intended to be achieved through the deployment of legal, economic and technological devices to increase the level of participation of indigenous Nigerian firms across the industry value chain. National and multinational oil companies operating in the country are mandated to procure a certain percentage of labor, products and services from the local pool, and to generally contribute towards building indigenous capacity in the industry. As a vital corollary, the Nigerian Content Development and Monitoring Board (NCDMB) was established to lead efforts towards the building of the requisite local capacity and the provision of an overall enabling environment.

<https://ideas.repec.org/a/eee/jomega/v17y1989i3p273-279.html> (accessed November 24, 2024).

²⁶ Upstream Online, “CENPES keeps Brazilian outfit at the cutting edge of production technology” (July 7, 2003) <https://www.upstreamonline.com/hc-technology/cenpes-keeps-brazilian-outfit-at-the-cutting-edge-of-production-technology/1-1-910055> (accessed November 24, 2024).

²⁷ Global Data, “Petroleum Nasional Berhad – Digital Transformation Strategies” (December 27, 2023) <https://www.globaldata.com/store/report/petroleum-nasional-bhd-enterprise-tech-analysis/> (accessed November 24, 2024).

²⁸ Section 106 *Nigerian Oil and Gas Industry Content Development Act*.

2.2 Preferential Treatment for Nigerian Oil and Gas Service Companies

According to the local content law, preferential treatment should be afforded to Nigerian ‘independent operators’ and ‘service companies. Digital technology service provision firms fall into the latter class of indigenous companies. In creating a space for their guaranteed participation, the law requires that they should be exclusively²⁹ considered in the procurement of services across the oil and gas value chain. Evidence over the years, however, indicates that only service providers from insurance, financial, legal, engineering, construction and fabrication sectors stand out as having greatly benefitted from this policy framework. Perennially, the information or digital technology services component took the back bench. One fundamental reason for this lackluster performance is that the ability to take advantage of the preferential treatment provision is contingent on the indigenous firms having the requisite capacity to carry out the required services which, alas, very few of Nigerian technology firms possess.

To effectively capitalize on the preferential treatment provision, indigenous digital technology service companies have to be able to “compete internationally on cost, quality and timeliness.”³⁰ Further, their exclusive consideration in terms of contract awards and other service engagements is contingent on a demonstrable “ownership of equipment, Nigerian personnel and capacity to execute ... contracts and services.”³¹ The trouble is that indigenous digital technology service firms with such qualifications are almost non-existent. A search by this writer reveals quite a few of them, with precisely only four firms approaching near the laid down criteria: **Snapnet Solutions**³², **IPI Solutions Nigeria Limited**³³, **EnServ (NNPC Service Company) Ltd**³⁴ and **SNL Technology Services**.³⁵

It is worthy of note that none of the identified companies are in the PETAN membership directory.³⁶ PETAN– the Petroleum Technology Association of Nigeria –is the umbrella body of indigenous technical oilfield services companies. The association aims to promote local participation through the building of competencies and capabilities and the growth of the industry through local content development. Out of the current 100 registered member companies, only two provide some services relating to digital technology. **Hobark International Ltd** is listed as a provider of IP Security Solutions, Mechatronics, Application Development, Networking, RFID, Secure ID, and ICT Consulting. The second one, **Lonadek Global Services**, provides a nebulous ‘Engineering/IT Solutions’ services.

²⁹ Section 3(2) *Nigerian Oil and Gas Industry Content Development Act*.

³⁰ Jegede, O. O. *et al.* “Knowledge Sharing and Innovation as it Affects the Local Content in the Oil and Gas Industry in Nigeria” *African Journal of Science, Technology, Innovation and Development* (2013) Vol. 5, No. 1, 31–38, p 32. <http://dx.doi.org/10.1080/20421338.2013.782145>

³¹ Section 3(2) *Nigerian Oil and Gas Industry Content Development Act*.

³² <https://snapnetsolutions.com/>

³³ <https://www.ipigroupng.com/>

³⁴ Business Day “SLB Nigeria, EnServ partner to deliver services to oil and gas industry” (May 25, 2024) <https://businessday.ng/bd-weekender/article/slb-nigeria-enserv-partner-to-deliver-services-to-oil-and-gas-industry/?amp> (accessed August 10, 2024).

³⁵ Nairametrics “Digitizing Nigeria’s Oil and Gas Sector: SNL Technology Services and IFS Partner to Transform Upstream Operations Through Digital Technology” (May 27, 2023) <https://nairametrics.com/2023/05/27/digitizing-nigerias-oil-and-gas-sector-snl-technology-services-and-ifs-partner-to-transform-upstream-operations-through-digital-technology/?amp=1> (accessed August 10, 2023).

³⁶ See <https://www.petan.org/wp-content/uploads/2019/11/PETAN-Member-Directory.pdf>

This extremely large shortfall in the availability of indigenous digital technology service providers creates a legal impasse with regard to the preferential and exclusive consideration mandated by the local content law. Having perhaps anticipated this sort of shortcoming, the lawmakers inserted an interim provision to take care of it by empowering the Minister to “authorize the continued importation of the relevant items”, “where there is inadequate capacity to any of the (local input) targets.”³⁷ This provision justifies the present continuous sourcing of digital technology services from foreign companies.

However, the foregoing provision comes with the caveat that the “approval by the Minister shall not exceed 3 years from the commencement of this Act.”³⁸ This means that there is a timeframe for the practice, the duration of which has effectively ended in 2013. Therefore, multinational and national oil and gas operators sourcing digital technology services from non-indigenous companies have since the year 2013 been in breach of Section 3(2) of the Act. It is clear, however, that the companies are not to blame as the position is being forced on them by the failure of Nigerian companies and regulators to ensure the existence of expertise and capacity in the area as envisaged under the law.

Several other factors are to blame for the unhappy state of affairs. One is the insufficient attention given to digital technology development by the regulatory agencies, notably the Nigerian Content Development and Monitoring Board (NCDMB). Emphasis in terms of implementation and patronage has always gone to the engineering, construction and manufacturing components. While they were all found to show some local content development promise since the early 2000s,³⁹ the engineering, construction and manufacturing components have gotten all the attention from governments and regulatory agencies to the detriment of the control systems and ICT components. In turn, the state of affairs has a lot to do with the tenor of the law vis-a-vis information or digital technology.

Several challenges have been identified as militating against the complete success of the local content development effort in Nigeria's oil and gas industry. Insufficient think-through, lack of political will to go through with policy implementation, weak institutional and industrial capacity, capital deficiency, uncertainty as to the scope of operations covered by the Act, lack of support from relevant stakeholders, corruption, and so on.⁴⁰ Although all components of the local input mentioned in this paper suffer from these challenges, the information technology and, consequently, digital technology component received the worst hit. In addition to the foregoing challenges, the segment particularly suffers from lack of attention from the relevant quarters.

3. Digital Oil And Gas Technology And The Nigerian Local Content Development Act

To drive the growth of Nigerian content in the industry, the local content Act divides oil and gas operations into different segments and specifies a certain percentage thereof to be provided or

³⁷ Section 11(4) *Nigerian Oil and Gas Industry Content Development Act*.

³⁸ Section 11(4) *Nigerian Oil and Gas Industry Content Development Act*.

³⁹ Heum, P. *et al.* “Enhancement of Local Content in the Upstream Oil and Gas Industry in Nigeria: A Comprehensive and Viable Policy Approach” Bergen: Institute for Research in Economics and Business Administration Report (2003) No. 25/03, p 35.

⁴⁰ Nwaguru, P. & Sylva, W. “Local Content Strategy Implementation in Nigeria: Challenges and Prospects” *African Journal of Business and Economic Development* (2022) Vol. 2, Issue 4, 34-42, p 39.

enjoyed in Nigeria by Nigerian providers and employees. However, as a technology services segment, digital technology has not been mentioned anywhere in the Act. This is understandable, as in the year 2010 when the law was passed, the term did not acquire the currency and transformative power it now possesses. The Act instead interchangeably mentions ‘Information Technology’, ‘Information Services’ and ‘Communication Services’ as the technology services for which Nigerian input is sought to be made, and in respect of which indigenous companies should be given preferential or exclusive consideration. The Schedule to the Act enumerated the following as the specific technology services contemplated.

- a) Network Installations Support/Support Services
- b) Software Development and Support Services;
- c) Computer Board Modeling Services;
- d) Computer based simulations/Training Progress Services;
- e) CAL/CAP Services;
- f) Hardware Installation Support Services;
- g) Operating Systems Installation/Support Services;
- h) User Support/Help Desk Services;
- i) Library Services;
- j) IT Management Consultancy Services;
- k) Data Management Services;
- l) Telecommunication Installation/Support Services;
- m) Data and Message Transmitting Services;
- n) Rental of Telecommunication Lines;
- o) Telecommunication Subscription Services;
- p) Public Address Systems Services;
- q) Other Information Systems/Information Technology Services.⁴¹

It would appear, at first sight, that the Act’s contemplation of information technology is a very elementary one. And that could be quite right with respect to, for example, network and hardware installations, user support, rental of telecommunication lines and public address systems. However, the list is still sufficiently amenable to application in the digitalized setting. For all practical purposes, software development, computer-based simulation, IT and data management, and the omnibus “other” information systems/information technology services can all fit into the purview of current digital technology services.

3.1 A Pattern of Disattention and Sidelining of Information/Digital Technology

Starting from the absence of ‘digital technology’ as a term in the Nigerian local content law, there has been a pattern of absence of emphasis on the technology segment. This terminological omission is followed by another more practical problem, namely that the expressly mentioned ‘information technology, information services’, and ‘communication services’ have not received the level of attention and emphasis that they truly deserve. As the forebears of digital technology, had the latter been sufficiently attended to, they would have organically graduated to the current desired state of technological digitalization. It is yesterday's information technology that metamorphosed into today's digital technology, following the very rapid trend of digital transformation that is at the heart of the fourth industrial revolution.

⁴¹ See Schedule to the *Nigerian Oil and Gas Industry Content Development Act*.

Let us take a look at one good instance of the sideline of information technology in the Act. As a general provision on the corporate establishment of oil and gas operations in Nigeria, Section 47 of the law requires all operators “to invest in or set up a facility, factory, production units or other operations within Nigeria for the purposes of carrying out any production, manufacturing or for providing a service otherwise imported into Nigeria.” However, when providing for the ministerial power to make regulations for the further growth of indigenous capacity for such operations, Section 41 restricts its explicit mentions to the following targets:

- a) Exploration,
- b) seismic data processing,
- c) engineering design,
- d) reservoir studies,
- e) manufacturing and fabrication of equipment, and
- f) other facilities as well as the provisions of other support services.

While exploration, engineering, manufacturing and fabrication are explicitly mentioned, the case has not been so with respect to information technology. Having not been explicitly mentioned, the inclusion of information technology in this particular list can only be constructed from a semantic extension of ‘seismic data processing’ or the ‘other support services’ omnibus. Furthermore, unlike information technology services, welding and fabrication received explicit mention and support in Section 53 which provides that from the “commencement of this Act, all operators, project promoters, contractors shall carry out all fabrication and welding activities in the country.”

With respect to insurance services, Section 49 requires that all operators “shall insure all insurable risks related to its oil and gas business, operations or contracts with an insurance company, through an insurance broker registered in Nigeria.” This obligation is further buttressed with the requirement that no “insurance risk in the Nigerian oil and gas industry shall be placed offshore without the written approval of the National Insurance Commission which shall ensure that Nigerian local capacity has been fully exhausted.”⁴² The same explicit mention and support were given to the legal and financial services components.⁴³ There is here, again, an absence of explicit mention and support for the information technology services component.

3.2 Information Technology as a Peripheral Oil and Gas Industry Support Service

Apart from the issue of express mention and emphasis, the information technology segment had been, and is still, largely understood and engaged with as a detached, standalone, oil and gas support service. That, in fact, is not the case as information technology solutions have always been in the thick of all operations in the industry. Information technology is central to all fields of specialization from geosciences to drilling engineering and petroleum economics. It is widely deployed in industry-wide operations, from the upstream exploration and appraisal of oil locations to the downstream transportation, marketing and retailing operations.⁴⁴

⁴² Section 50 *Nigerian Oil and Gas Industry Content Development Act*.

⁴³ Section 51 & 52, *Supra*.

⁴⁴ Okwelum, C.O. “Critique of Manpower Development in the Oil and Gas Sector of Nigeria” *Int. Journal of African Sustainable Dev Research* (2022) Vol 9, p 67.

The negative effects of the lack of emphasis and neglect for digital technology under the current regulatory framework are as far-reaching as they are difficult to actually quantify. Consider this impactful negative outcome. First generation oil and gas technology service companies (such as **Schlumberger** and **Halliburton**) that have been in the industry right from its inception and new digital technology services giants (such **Amazon Web Services**) have all these years been easily escaping their extensive local content development obligations under the law. Industry-sensitive examples here include the obligation on multinational oil companies to go into joint ventures and other forms of beneficial alliances with Nigerian digital technology service firms,⁴⁵ and the accompanying programs for the transfer of technology to such companies.⁴⁶

3.3 An Information Technology Void in the Nigerian Content Consultative Forum (NCCF)

The Nigerian oil and gas local content development law requires the establishment of a consultative forum which is to function as a platform for the sharing of information and collaboration with respect to oil and gas industry projects, information on available local capabilities, and other relevant local content development policy proposals. According to Section 58 of the law, the Forum is to be populated by key stakeholders, regulatory agencies and representatives from the following industry components:

- a) fabrication,
- b) engineering,
- c) finance services, legal and insurance,
- d) shipping and logistics,
- e) materials and manufacturing,
- f) information and communication technology,
- g) petroleum technology association of Nigeria,
- h) education and training, and
- i) any other professional services nominated by the Board.

All the above listed industry segments have appropriate representations in the Nigerian Content Consultative Forum except the information and communication technology segment. The fabrication sector had representation in the forum as early as 2010. Engineering is being represented by the Oil and Gas Design Engineers of Nigeria (OGDEN). Materials and manufacturing had the Manufacturers Association of Nigeria Local Content Group (MANLOC). Shipping and logistics have the Nigerian Chamber of Shipping. Education and training have the Oil and Gas Trainers Association of Nigeria (OGTAN).⁴⁷ The Petroleum Technology Association of Nigeria (PETAN) is the representative of all classes of technology. However, in line with the trend of neglecting the segment, information technology has no currency in the association and therefore stands no chance of being represented in the forum.

3.4 Notable Pro-Digital Technology Development Initiatives

It is of great significance to clarify that the issue with the content development law on the subject of digital technology services is not that of total omission but that of lack of explicitness and

⁴⁵ Section 45 *Nigerian Oil and Gas Industry Content Development Act*.

⁴⁶ Section 43 - 45, *Supra*.

⁴⁷ Ovadia, J. "Measurement and Implementation of Local Content in Nigeria: A Framework for Working with Stakeholders to Increase the Effectiveness of Local Content Monitoring and Development" Facility for Oil Sector Transparency in Nigeria (FOSTER) Project (January 2013) p 30.

emphasis. This is to say that it is not an issue that requires some tangential or far-flung exercises in legal interpretation and construction to be solved. It is an issue that can be easily addressed by the regulators highlighting and giving a similar amount of attention to the digital technology segment that has been given to the other local content input segments.

There is one early instance of this kind of approach that could have immensely aided the trajectory of digital technology development in the Nigerian oil and gas industry. That is the issuance of an ICT Guidelines by the local content development board in 2012.⁴⁸ Targeting original ICT equipment manufacturers (OEMs) and contractors, the guidelines required, *inter alia*, that the design, procurement, installation of ICT equipment and support services shall be executed by indigenous companies, Nigerian subsidiaries of international OEMs and Nigerian partners of international OEMs. It also requires ICT OEMs to submit a plan to the board for the manufacture of ICT hardware components in Nigeria, within 3 months of coming into force, and to submit a Nigerian Content Performance Report to the NCDMB by March 1st of every year. Commenting on the document, Ovadia was convinced that “the successful implementation of local content in ICT will increase revenue and promote growth throughout the Nigerian economy.”⁴⁹ Regrettably, the benefits to the country could not materialize as the guidelines never came into operation and had since been forgotten.

A more recent, more powerful, illustration of the desired kind of approach is the lone experiment by the former executive director of the local content development board, Engr. Simbi Kesiye Wabote, in organizing the Nigeria Oil and Gas Technology (NOGTECH) Hackathon in 2020.⁵⁰ The first of its kind effort to stimulate the emergence of oil and gas technology startups in the country, the NOGTECH hackathon called for and received a total of 635 applications for digital technology solutions that have the potential to solve some of the problems facing the industry. The five winning submissions were each awarded the sum of \$10,000, and a 3-month incubation package consisting of workspaces, mentorship, and access to key oil and gas industry players as prospective business partners.⁵¹

One of the outstanding participants, **Fuel IntelliSense**, came up with a solution that helps fuel stations to obtain accurate data which they can then leverage to guard their underground tanks against oil theft. It also features a remote tank monitoring system that displays the daily volume of fuel dispensed and the volume that remains at the end of the day. Another participant, **Airsynq**, developed a balloon-floated satellite surveillance system that enables companies to monitor the state of operations and the status of assets across their fields.

This is exactly the kind of attention and focus needed to develop Nigerian capacity and expertise in the area of digital technology solutions in the oil and gas industry. And this is not a particularly out-of-the-box intervention but a simple object-oriented engagement with the provisions of the local content law. According to Section 5 thereof, the content development and monitoring board

⁴⁸ *Ibid*, p 7.

⁴⁹ *Ibid*, p 8.

⁵⁰ See <https://nogtech.ng/>

⁵¹ Tech in Africa, “5 Nigerian startups win \$50,000 prize for their Oil & Gas Innovations” (December 10, 2020) <https://www.techinafrica.com/5-nigerian-startups-win-50000-prize-for-their-oil-gas-innovations/> (accessed November 20, 2024).

“shall implement the provisions of this Act with a view to ensuring a measurable and continuous growth of Nigerian content in all oil and gas arrangements, projects, operations, activities or transactions in the Nigerian oil and gas industry.” Several other provisions for this effect are contained in the law. The only remarkable thing about the NOGTECH initiative is the agency's purposive application of those provisions to the benefit of digital oil and gas technology. Interestingly, in a stunning illustration of the kind of nonchalance that this article is trying to expose, the NCDMB has not remained faithful to its promise of keeping the Hackathon as an annual affair. There has not been a rerun of exercise since the maiden edition of June 2020!

4. Digital Oil And Gas Technology And The Petroleum Technology Development Fund

The Nigerian Petroleum Technology Development Fund (PTDF) was established in 1973 with the main mandate of training and educating Nigerians for the oil and gas industry. It has the vision of developing indigenous manpower, domiciliation of oil and gas technology and the making of Nigeria as the West African human resource capital. Long before the coming of the local content development law, the PTDF pioneered the introduction of the initiative in Nigeria through instruments such as Regulation 37 under the Petroleum Act, and the Petroleum (Drilling and Prod) Regulations of 1969.⁵² At one point in time, the PTDF even came to be saddled with the responsibility of achieving a 100 percent Nigerian content in the industry. For these and other good number of reasons, this agency is well-placed to promote the development of capacity in digital technology services in the Nigerian oil and gas industry.

More strategically, the agency's mandates include developing technology that would replace outdated practices, ensuring international best practices and dynamic operations in the industry. Under the inspiration of the then Petroleum Industry Bill, the mandates grew to encompass other important matters such as periodic evaluation and updating of the industry's needs in terms of expertise and skills needed to remain competitive.⁵³ The Nigerian oil and gas industry would definitely have kept pace with the current digitalization trend had the PTDF carried the information technology services segment along with the other traditional segments.

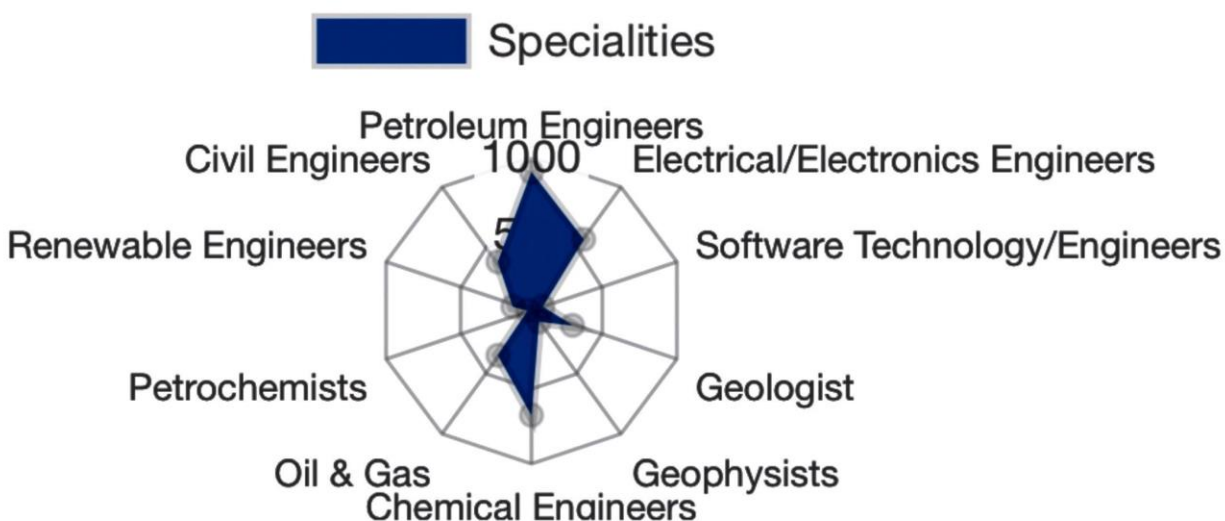
The more popular interventions of the PTDF were in the areas of upgrades of technology training institutions, university professorial chairs and scholarships. There are currently eight professorial endowments in the University of Ibadan, Ahmadu Bello University, University of Nigeria Nsukka, Usman Dan Fodio University, University of Jos, University of Maiduguri, University of Port Harcourt and University of Benin. These universities receive periodic updates to support the endowments in departments offering traditional petroleum courses in Geology, Mining, Gas Engineering, Petroleum Engineering, Chemical Engineering and Petroleum Chemistry.⁵⁴ Despite its importance as a self-standing field of knowledge and practice, and the fact that it runs through all the foregoing areas of learning and research in oil and gas, information/digital technology has not received any such endowment.

⁵² Adekalu, S.O. *et al.* “Petroleum Technology Development Fund (PTDF) Mandates and Human Capacity Development in Nigeria: Benefits for Nigerian Youths” *Int. Journal of Research in Management* (2013) Issue 3, Vol.5, p 71.

⁵³ *Ibid* at 69.

⁵⁴ Okwelum, *Supra* note 44 at 66.

The PTDF finances scholarships, both local and overseas, enabling Nigerians to study in the United Kingdom, France, Germany, Malaysia, and other top foreign locations. This is with the grand aim of meeting the industry's long-term needs in engineering, geological sciences, environmental and energy studies. The expectation is for the returning scholars to be absorbed into, and contribute to the development of, the Nigerian oil and gas industry and the larger economy. The local scholarships for studies in Nigerian universities was originally conceived to effectively leverage the upgrades and endowments that go into such institutions.⁵⁵ Here also, information technology is completely not in the picture. As shown below the software technology speciality records virtually no activity as far as both overseas and local scholarships are concerned.



Source: PTDF Intervention Database, 2024.

Aside from the explicitly mandated functions relating to scholarships, institutional upgrades and university endowment programmes, PTDF has devised a number of creative initiatives over the years in furtherance of its aims and objectives. The notable ones include the Catch Them Young Competition (CTYCP), the Annual Oil and Gas Research Grant Competition, the Technology Knowledge Sharing Programme (TKSP), and the Engineering Design Training Programme (EDTP).⁵⁶ Information technology has not been opportune to significantly feature in all these impactful programmes. Interventions to the segment have been restricted to basic 'ICT Projects' consisting of building computer centers and the provision of laptops and other simple accessories.

While the information technology segment remained underserved, PTDF demonstrated its capacity for implementing comprehensive training programs in other segments. With respect to the engineering services segment for example, the local content Act required a 90 percent Nigerian man-hours input in front end engineering design (FEED), detailed and other engineering services on onshore and onshore facilities. To satisfy this requirement, the PTDF's leadership, long before

⁵⁵ *Ibid* at 65.

⁵⁶ Adekalu, *Supra* note 52 at 70.

the coming of the local content Act in 2010, devised the Engineering Design Training Program (EDTP) mentioned above. The EDTP program featured specialized training on a wide range of software packages for engineering design purposes, all geared “towards up-skilling the 2,600 engineers necessary to meet the 5 million man-hours required to domicile all design projects in Nigeria.”⁵⁷ The local content requirements with respect to information and digital technology would have greatly benefited from similar initiatives from the PTDF.

Although significant strides have been made in developing traditional petroleum technology capabilities through various initiatives, the approach of both the PTDF and the NCDMB to digital technology development has remained notably limited. The two agencies’ focus on conventional engineering, fabrication and geological sciences, though valuable, reflects a broader systemic issue in Nigeria's oil and gas local content development drive. Despite the oil and gas industry's global shift toward digitalization, interventions in information and digital technology have largely been minimal and restricted to basic infrastructure provisions rather than comprehensive digital capability development. This misalignment between Nigeria’s traditional technology focus areas and the industry's evolving digital needs exemplify a larger strategic oversight in Nigeria's oil and gas technology development framework.

5. Conclusions And Recommendations

The analysis presented in this article reveals a critical gap in Nigeria's oil and gas technology development framework, namely the systematic neglect of digital technology development despite its transformative potential. This oversight stems from three primary factors: (1) an outdated conception of technology that emphasizes physical and mechanical functionality over digital solutions, (2) the peripheral treatment of information technology in the Nigerian Oil and Gas Industry Content Development (NOGID) Act, and (3) insufficient attention to digital technology development in the implementation strategies of key regulatory bodies, particularly the Nigerian Content Development and Monitoring Board (NCDMB) and the Petroleum Technology Development Fund (PTDF).

The consequences of this neglect are far-reaching. While other segments of the local content development initiative have shown measurable progress, indigenous digital technology service provision remains far behind. This has created a persistent dependence on foreign digital technology service providers, effectively undermining the core objectives of Nigeria's local content development strategy. As the global oil and gas industry rapidly digitizes, this gap threatens to widen further, potentially leaving Nigeria behind in the ongoing digital transformation of the energy sector.

The following comprehensive recommendations are made towards developing globally competitive Nigerian digital oil and gas technology service providers.

1) Policy Framework Enhancement

- i) The Nigerian oil and gas industry local content development framework should be adjusted to explicitly recognize and emphasize digital technology as a distinct, critical oil and gas local content segment.

⁵⁷ Mohammed, K.A. “Nigerian Content Development: The Petroleum Technology Development Fund Initiatives” *Petroleum Technology Development Journal: An International Journal* (July 2009) Vol. 2. p 4.

- ii) Clearly defined digital technology transfer protocols should be put in place for international oil companies and service providers.
- iii) Specific local content targets should be created for digital technology services, similar to those existing for engineering and fabrication.
- iv) The NCDMB and the PTDF should strategically enlist the participation of the National Information Technology Development Agency (NITDA) in their Implementation efforts.

2) *Institutional Capacity Building*

- i) A dedicated Digital Technology Directorate should be established within the NCDMB.
- ii) A digital technology representation should be promptly instated in the Nigerian Content Consultative Forum as required by the Act.
- iii) Develop a comprehensive digital technology roadmap with clear milestones and implementation strategies.

3) *Education and Training Enhancement*

- i) Introduce PTDF professorial chair endowments specifically for digital petroleum technology in major Nigerian universities.
- ii) Encourage and give preferential treatment for digital technology applicants in the PTDF scholarship schemes.
- iii) Establish dedicated training programs for oil and gas digital technologies, similar to the Engineering Design Training Programme.
- iv) Create partnerships with leading global digital technology companies for knowledge transfer and training.

4) *Industry Collaboration and Innovation Support*

- i) Reinstate the NOGTECH Hackathon as an annual event with increased funding and industry support.
- ii) Create incentives for joint ventures between international digital technology service providers and Nigerian firms.
- iii) Develop a mentorship program pairing established digital technology companies with Nigerian digital technology startups.
- iv) Develop other special financial support mechanisms for digital technology startups.