




DOI: 10.22363/2313-0660-2022-22-2-385-396

Research article / Научная статья

## Technology Policy and Sustainable Development in Nigeria

Ejiroghene A. Oghuvbu  , Daniel E. Gbervbie , Samuel O. Oni 

Covenant University, Ota, Nigeria

 [augustine.oghuvbupgs@stu.cu.edu.ng](mailto:augustine.oghuvbupgs@stu.cu.edu.ng)

**Abstract.** In the 21st century, the government and people of Nigeria are placing special emphasis on the technological component of development. In today's world, technology has a critical impact on people and all areas of societal development, from communications and transport to construction and health care. In this study, the term “technology” is used in a broad context, referring to the knowledge, competencies and skills strongly required for technological development. Methodologically, the research is based on the secondary sources — monographs, academic articles and Internet resources. The main idea of the research is to comprehensively analyze the Nigeria's technology and sustainable development policies. The performance of these efforts has been rather poor, preventing Nigeria from reaching a technological level comparable with that of developed economies. Rich in mineral resources Nigeria must initiate the development and adoption of modern technology to accelerate its economic growth. A review of Nigeria's technology policy in the context of a long-term development is required. With a more thorough approach to the development of production functions and operations, such as quality control, maintenance, planning, etc., the level of national development would be much higher than at present. In the case of Nigeria, qualitative improvements in industrial production are directly linked to such factors as knowledge, expertise and experience. Overall, the authors conclude that vocational training for the sub-Saharan Africa sub-region is the key to bringing the respective countries to a new level of technological development. Meanwhile, in seeking technology, Nigeria must strive to strike a balance between industrial development and the environment in order to achieve sustainability.


**Key words:** technology, technology policy, sustainable development, Nigeria

**For citation:** Oghuvbu, E. A., Gbervbie, D. E., & Oni, S. O. (2022). Technology policy and sustainable development in Nigeria. *Vestnik RUDN. International Relations*, 22(2), 385—396. <https://doi.org/10.22363/2313-0660-2022-22-2-385-396>

## Технологическая политика и устойчивое развитие в Нигерии

Э.А. Огуббу  , Д.Э. Гберевбие , С.О. Они 

Университет Ковенант, Ота, Нигерия

 [augustine.oghuvbupgs@stu.cu.edu.ng](mailto:augustine.oghuvbupgs@stu.cu.edu.ng)

**Аннотация.** В XXI в. правительство и население Нигерии делают особую ставку на технологический компонент развития. В современном мире технологии оказывают наибольшее воздействие на людей и все сферы общественного развития — от коммуникаций и транспорта до строительства и здравоохранения. В рамках данного исследования термин «технологии» используется в широком контексте, в том числе применительно к сфере знаний, компетенций и навыков, необходимых для технологического развития. Методологически исследование основывается на анализе вторичных источников — монографий, научных статей, интернет-ресурсов. Главный акцент сделан на изучении политики Нигерии в сфере технологическо-

© Oghuvbu E.A., Gbervbie D.E., Oni S.O., 2022



This work is licensed under a Creative Commons Attribution 4.0 International License.

<https://creativecommons.org/licenses/by/4.0/>

го и устойчивого развития. Страна, располагающая богатыми минеральными ресурсами, для ускорения темпов экономического роста должна инициировать разработку и внедрение современных технологий. Однако результативность прилагаемых усилий довольно низкая, что не позволяет выйти на сопоставимый с развитыми экономиками технологический уровень. В этой связи требуется пересмотр технологической политики в контексте долгосрочного развития Нигерии. При более основательном подходе к развитию производственных функций и операций, таких как контроль качества, техническое обслуживание, планирование и др., уровень национального развития был бы гораздо выше нынешнего. В случае с Нигерией качественное улучшение промышленного производства напрямую связано с такими факторами, как знания и опыт. В целом авторы приходят к выводу, что профессиональное техническое обучение населения субрегиона Африки южнее Сахары является залогом выхода стран на новый технологический уровень развития. При этом в борьбе за технологии Нигерия должна стремиться к обеспечению баланса между развитием промышленности и состоянием окружающей среды для достижения устойчивости.

**Ключевые слова:** технологии, технологическая политика, устойчивое развитие, Нигерия

**Для цитирования:** *Oghuvbu E. A., Gberevbie D. E., Oni S. O. Technology Policy and Sustainable Development in Nigeria // Вестник Российского университета дружбы народов. Серия: Международные отношения. 2022. Т. 22, № 2. С. 385—396. <https://doi.org/10.22363/2313-0660-2022-22-2-385-396>*

## Introduction

To fully understand technology, one requires knowledge of the technology itself. Therefore, the term “technology” encompasses not only university technical disciplines and special equipment, but also the knowledge and the expertise needed to perform most functions in a modern enterprise. This knowledge includes technical skills, ideas, and equipment that enterprises apply to manufacture and market goods or deliver services.

In the 21st century, technology arguably has the most profound impact on individuals and society. In the case of Nigeria, the technological factor has become truly important in terms of economic development. The daily lives of people in Nigeria are largely determined by the technology used for housing, transportation, office and manufacturing, health care, entertainment and communications. Nigeria’s policy makers expected industrial development to transform low-technology, low-productivity and slow-growth economies into dynamic and modern ones. However, this has not yet happened in the sub-region (Eckardt, 2014).

The logic of exporting technology from those who have it to others who do not is appealing. Most Nigerian leaders believed that the rise of manufacturing was driven by the belief that modern technology and new talent would change the structure of comparative advantages. Past industrial programs tended to focus on increasing production capacity rather

than establishing institutional systems and boosting local capacity to make these facilities more efficient. It is important to bear in mind that most of Nigeria’s post-independence enterprises were capital-intensive and built as turnkey projects by foreign companies, with little transfer of technological capacity to local managers and technicians (Mukoro, 2020).

One of the major problems confronting research in Nigeria is the lack of reliable data, statistics, and documentation on almost every aspect of life in the country. Public institutions, whose work is significantly affected by this fact, nevertheless make so little effort to rectify the situation. In the past, industrialization policies and strategies in Nigeria have discriminated against small and medium-size industries, leaving them without access to credit and foreign exchange.

Nigeria is gradually beginning to recognize the vital role of science and technology as the primary vehicle for promoting development. But this recognition has not been matched with investment in the necessary resources, both human and material. Funding of science and technology in the country has never been any significant priority and has often occurred as a result of external intervention rather than a conviction of its appropriateness and necessity. In addition, science and technology remain largely in the public domain, where they are perceived mainly in terms of building research institutions or developing a technical manpower.

In the latter case, the emphasis is usually placed on formal technical training rather than on building skills, practical experience, and innovation. Unfortunately, policy-makers in Nigeria continue to have a vague understanding of the role of science and technology and have thus failed to optimize their use for national development planning. As a result, many African scholars emphasize that there is a distinct lack of political consciousness and commitment to the development of science and technology (Adubifa, 1990; Lall & Wangwe, 1998; Mukoro, 2019; Udo & Edoho, 2000).

Improving technology is one of the critical factors needed for the industrialization of Nigeria, a goal that seems to be shared by almost everyone. However, the sub-industrial region's activity structure is still underdeveloped. In contrast to Asia and Latin America, which have expanded and deepened their range of more sophisticated operations, the country is dominated by processing of local natural resources and simple consumer goods sectors. The country's industry has therefore failed to achieve structural transformation, export dynamism or technical efficiency, delivering only a fraction of the promised growth and externalities. Some scholars are concerned that Nigeria is on a collision course with resource scarcity and environmental degradation. This concern has led to the concept of sustainability, to ensure that future generations in Nigeria are not deprived of a critical part of their heritage. However, sustainability is a complex and ambiguous concept that is difficult to translate into actual practice (Lawal & Oluwatoyin, 2011; Lipumba, 1994).

A qualitative research methodology has been adopted for this study, as it is aiming to analyze technology policy and sustainable development in Nigeria, which will help to look at the state of technology in Nigeria in the 21st century. The author examines the problem of technology development in Nigeria. Exporting appropriate technology will provide Nigeria with the necessary skills to make rational investment decisions and lead to sustainable growth and development thereafter. In the process of seeking technology the Nigerian government should

endeavor to balance industrial promotion and environmental conditions in order to achieve sustainability. Suggestions are offered on how Nigeria can improve its technology.

### **Sustainability and Technology Development**

Technology in general refers to the various components of productive knowledge that assist in converting raw materials into finished products, developing new and improved products, and developing better and more efficient methods of service delivery. The evolution of technology in Nigeria has elements of history and natural endowment, culture and national discipline. It also has factors of environment and collective national aspiration, elements of knowledge and resourcefulness, and factors of politics and ideology (Soares, Kovaleski, Gaia & Chiroli, 2020).

Thus, technology can be seen as the interaction of science and society. In doing so, it is important to define the understanding of sustainability or sustainable development. It is "a transformation process in which resource exploitation, investment direction, technical development orientation, and institutional change are all in sync and increase both current and future potential to meet human wants and ambitions" (Soares, Kovaleski, Gaia & Chiroli, 2020).

In developing countries, finding alternatives to many of the development practices that are now draining their resources is a key component of sustainable development. Knapper (2016) pointed out that sustainable development in developed countries simply means reducing consumption. This would require developing plans for more efficient use of the current resources, as well as exploiting more fully the solar, wind and thermal energy sources. Both Nigeria and Western industrial countries could cooperate to develop policies that meet basic human needs around the world.

Sustainable development may seem to some, especially in Nigeria, to be an abstract concept of interest primarily to industrialized countries that can afford to worry about such things. Proponents insist that the first order of business

is to develop, then to clean up later. However, the problems underlying sustainable development apply to all countries without exception. Contaminated air and water can significantly slow down development, for example by causing health problems or reducing agricultural production. In addition, global warming is likely to hurt Nigeria at least as much as others because highly stressed and barely adequate agricultural systems will have great difficulty adapting to climate changes (Oladipo & Grobler, 2020). It is therefore in the interest of the Nigerian government to position its development in line with the principle of sustainability. “The missing component model is predicated on the idea that development can be affected by identifying the critically weak or missing element in developing a country’s assets and by subsequently providing this component. Such missing elements typically are identified as domestic saving, foreign exchange, education and technology. The capacity of technology to transform nature in Nigeria for the purpose of development is such that the question of who controls technology is central to who controls development” (Udo & Edoho, 2000, p. 120).

The difficulty with a development plan that emphasizes the acquisition of foreign exchange is that it leads to foreign currency dominance and overcapitalization in sub-Saharan Africa at the cost of a more balanced use of domestic resources. One negative consequence can be the overuse of labor as a substitute for capital. Most of the arguments in favor of the concept of appropriate technology are based on this second criterion. The importance of technology efficiency in the development process cannot be overstated. Ultimately, this will prove to be a way for developing countries, such as those in sub-Saharan Africa, to move out of poverty and achieve the goals outlined in the basic human needs approach.<sup>1</sup>

As some scholars have pointed out, capacity building is essential for the successful transfer of

---

<sup>1</sup> Yusuf O., Shogbanmu S. Reigniting Growth and Sustainable Development in Nigeria // Verraki: Business Solutions for Africa. May 2021. URL: [https://verraki.africa/wp-content/uploads/2021/05/Reigniting-growth-and-sustainable-development-report\\_May-2021.pdf](https://verraki.africa/wp-content/uploads/2021/05/Reigniting-growth-and-sustainable-development-report_May-2021.pdf) (accessed: 23.02.2022). See also: (Yekini, 2014).

new technology to poor countries; simply improving equipment and operating instructions, patents, designs, or blueprints does not guarantee that the technology will be successfully used (Lall, Navaretti, Teitel & Wignaraja, 1994). For Ofori three functional categories of technological capacities are the most important for developing countries to successfully transfer technology (Ofori, 1994). These functional categories include investment capability (skills and information needed to identify and determine feasible investment); production capability (skills, knowledge, and experience imperative for running an operation and improving the plant); linkage capabilities (skills required to create, maintain, and build technology connections with other businesses and institutions).

The use of any technology is not an end in itself. The criteria for making an effective technical decision in Nigeria must be found in the country’s most important development goals and procedures. Mukoro (2020) argues that the description of situations in which technology is applied determines both private and public aspects. The technology used in a small family-owned business is referred to as private technology. It has to do with the manufacture of consumer goods, and it is mostly an individual entrepreneur’s decision. Examples of “public technology” include large industrial firms producing consumer goods or capital equipment, as well as national institutions providing basic services such as rail transport, flood control and irrigation systems, electricity grids, higher education, banking and credit systems. As a result, in Nigeria, technological advances imply new methods that surpass existing national standards, but do not necessarily have to be on top of the world. This is due to the fact that Nigeria is still in the early stages of industrial and agricultural development (Mukoro, 2020).

Sub-Saharan Africa has embraced technology transfer strategy as a principal means of incorporating technical change into their productive structure (Marais, Grobbelaar & De Kock, 2021; Yusuf and Shogbanmu<sup>2</sup>).

---

<sup>2</sup> Ibid.

Technological change, however, is a multi-dimensional phenomenon: it involves changes in the socio-cultural, cognitive, and managerial attributes of society. Transforming changes in the socio-cultural, cognitive and governance attributes of sub-Saharan African societies into a concept of policy sustainability raises important questions about how global social capital or assets should be shared between present and future generations. This capital consists of four components: man-made capital such as roads and factories, scientific and technical knowledge, natural capital such as fossil fuels and mineral deposits, and environmental assets such as clean air and water and a diverse biological base (Marais, Grobbelaar & De Kock, 2021). There is typically little concern over the first two. It is assumed in line with historical experience at least over the past three or four centuries; that each generation will be able to hand down to future generations an improved stock of both technical knowledge and manmade capital. This concern was also addressed by the World Bank and International Monetary Fund (IMF) structural adjustment policies prescription to developing nations in the 1980s and 1990s (Woyo, Rukanda & Nyamapanda, 2020).

As Lipumba (1994) points out, environmental protection was not the original objective of the structural adjustment programs that were prescribed by the World Bank and IMF in the 1980s and adopted by African countries. The aftermath of the programs was that the impact of adjustment on the environment was previously ignored. The promotion of certain exports such as tropical wood and flue-cured tobacco, which was undertaken in some areas as part of the adjustment effort, could result in deforestation. On the balance, there is no good evidence that adjustment policies have had either a positive or negative impact on the environment. Rapid population growth rate and overgrazing are more formidable threats to the environment than adjustment. Overall, the policy challenge for sub-Saharan Africa is to maintain the delicate balance between population growth and agricultural and technological development on the one hand, and the protection of the environment on the other (Niebel, 2018).

## **The Evolution and the Quest for Technology Transfer**

Looking back at the performance of the early colonial officers in terms of their responsibility for national planning and the circumstances in which they functioned is the best way to describe the evolution of technology transfer in Nigeria. The relationship between the colonial heritage and the indigenous civil service after independence, as well as subsequent evolution and change based on the colonial foundation, may then be traced. Before 1960, the colonial civil service in charge of Nigeria was never meant to build or manage industries or the production system. It was simply meant to preserve law and order in the colonial government's interest and promote trade and acquisition of raw materials. During the pre-independence period in Nigeria, there was no clear policy for science and technology. The only policy that was in place was an industrialization plan. This plan was only implicit in nature because the concern of the European colonial authorities was mostly commercial (Soares, Kovaleski, Gaia & Chiroli, 2020). The colonial administration's goal was to promote the development and transfer of agricultural commodities as raw materials for Europe (Knapper, 2016).

The colonial civil service was essential in the entry of foreign firms into Nigeria, rather than directly establishing enterprises. First, multinational firms mostly engaged in commerce and transportation, acquiring and shipping raw materials from the sub-region to developed-country industries. Second, international firms delivered finished goods to the Sub-Saharan African market, particularly textiles and processed foods. Third, international firms later introduced the import-substitution approach, which became the first industrialization process to be implemented domestically in Nigeria (Marais, Grobbelaar & De Kock, 2021; Wangwe, 1995). It could therefore be argued from the outset that the colonial administration was not concerned with the setting-up of industrialization or the provision of infrastructure. The colonial administration also did not create any formal

mechanism for participation in the production system as a function of government.

With independence, Nigeria started to recognize the importance of industrialization as a major vehicle for national development. Unlike other developing countries which had successfully utilized appropriate strategies for their own purpose, the Nigerian government's strategy for industrialization was initially that of total reliance on foreign private investment supported by generous tax rebates and pioneer incentives. Import substitution was the primary objective. The issues above, therefore, point to a certain pattern of technological development that was inappropriate and resulted from policy failures in development planning. By failing to establish centralized coordination of technological activities, the nation achieved a high-cost assortment of desirable and undesirable technological inputs (Gray, 2017).

At present, Nigeria remains a technologically inferior, poor, and dependent economy (Biggs, Shah & Srivastava, 1995; Ihonbere, 1994; Mukoro, 2019). In the context of Africa, however, the structures of the Nigerian economy appear relatively developed, but when viewed on a worldwide basis, they are less so. The fact remains that foreign interests dominate Nigeria's economy, and the society is characterized by a lack of discipline, and corruption, for the vast majority, political instability, ethnic, religious, and regional cleavages, and a general lack of fundamental human requirements exist.

The World Bank has reported a decline in technology development activities in the years following the introduction of the structural adjustment programs. This was reflected in the drop in the fourth quarter of 1999, the aggregate index of industrial production was expected to be 22.8% (1985 taken as 100%). In 1994 and 1995, reductions of 5.0 and 5.1% were observed, respectively. Manufacturing and mining output declined by 8.3 and 9.8% in 1996 and the first quarter of 1997, respectively, contributing to the decline in industrial production. The index decreased by 15.7% in the third quarter of 1998, owing partly to the persisting political instability

in most Sub-Saharan African countries and the difficulty in obtaining foreign cash for the import of raw materials and machinery spare parts. Furthermore, industrial production declined by 1.8% in the first quarter of 2019, 2.5% in the third quarter of 2020, and 2.6% in the third quarter of 2021.<sup>3</sup>

Generating human resources for effective technology transfer could be done through the development of formal education (Lall, 1999). Industrial training is just as crucial, if not more so. While comparable data isn't accessible, anecdotal evidence shows that Sub-Saharan African countries (particularly Nigeria) (Table 1) lag behind in vocational and technical training. Most industrial companies spend little or no money on employee training, merely giving the rudimentary skills required to run specific technologies. Furthermore, with new technologies and organizational forms, the nature and extent of demand for industrial skills is rapidly changing in the direction of multi-skilling teamwork, reliability and flexibility, and continuous education; the gap between Nigeria and other industrialized nations is widening rather than closing (Yekini, 2014).

Table 1 shows enrollment rates in vocational and technical subjects in universities in some Sub-Saharan African countries in comparison with nations in Asia and Latin America. Vocational and technical training is how high-level human capital for technological transfer and industrial development can be achieved. The table shows that Latin American and Asian countries fare better in the technical and vocational training that they provide for their citizens. The table provides data for South Africa as well as the four relatively advanced less developed African economies, Ghana, Kenya, Zimbabwe, and Nigeria. The other sub-Saharan

<sup>3</sup> See: Selassie A. A., Hakobyan S. Six Charts Show the Challenges Faced by Sub-Saharan Africa // IMF. April 15, 2021. URL: <https://www.imf.org/en/News/Articles/2021/04/12/na041521-six-charts-show-the-challenges-faced-by-sub-saharan-africa> (accessed: 23.02.2022); World Development Report 2000/2001: Attacking Poverty // The World Bank. Washington, DC: The World Bank, 2001. P. 296. URL: <https://openknowledge.worldbank.org/handle/10986/11856> (accessed: 23.02.2022).

African countries are very much further behind. South Africa is clearly in front of other sub-Saharan African nations, and it has approached the levels reached in some relatively advanced Asian or Latin American nations.

Table 1

**Educational Enrollment at all Levels in Vocational and Technical Subjects at Universities**

Country	Vocational training		Enrollment in Technical Field	
	Number	% of population	Number	% of population
<b>Africa</b>				
Ghana	22,578	0.15	712	0.00
Kenya	7,8401	0.04	1,046	0.00
S. Africa	47,801	0.15	19,958	0.06
Zimbabwe	0	0.0	4,718	0.04
Nigeria	20,450	0.12	74,000	3.00
<b>Asia</b>				
Korea	1,483,198	3.33	437,537	0.98
Taiwan	513,700	2.46	179,094	0.86
Singapore	9,391	0.32	13,029	0.47
Malaysia	90.079	0.48	12,693	0.07
Philippines	NA	0	201,701	0.29
Thailand	545,791	0.92	51,949	0.09
<b>Latin America</b>				
Chile	277.226	1.98	85,483	0.61
Mexico	835.079	1.03	221,867	0.27
Argentina	1,084,531	3.22	96,205	0.29
Brazil	1,480,997	0.99	149,660	0.10

Source: (Lall & Wangwe, 1998; Oviawe, 2017).

All the expenditures on research and development (R&D) fell by 0.9% in 1995 and 26.6% in 1996 from the 1985 level. As in previous years, the expenditure on R&D continued to account for a dismal fraction (1.7%) of total investment expenditure in sub-Saharan Africa.<sup>4</sup> At the end of 1998, the situation in the public and private sectors deteriorated further due to a decline in production and a low overall capacity utilization rate. Poor implementation of structural adjustment programs, insufficient funding, especially for working capital, currency restrictions on the purchase of necessary raw materials and spare parts, high operating costs, frequent equipment breakdowns, and a wave of political instability were blamed for the poor performance.

<sup>4</sup> Human Development Report 1999 // UNCTAD. New York: Oxford University Press, 1999. URL: [https://hdr.undp.org/sites/default/files/reports/260/hdr\\_1999\\_en\\_nostats.pdf](https://hdr.undp.org/sites/default/files/reports/260/hdr_1999_en_nostats.pdf) (accessed: 23.02.2022).

Finally, technology is still widespread in Nigeria and many sectors of the economy rely on it and are affected and affected by it. Technology also serves as a link between production and employment, as well as between the economic system and the environment. As a result, the development strategy required effective public-private control over technology. Nigeria must be able to choose appropriate items and technology and assure its supply in order to drive the growth process. Suppliers can be discovered through an indigenous design and development efforts or by acquiring goods from overseas and adapting and changing them to match local requirements (Mukoro, 2020).

Only a careful rethinking of Nigeria's goals (the demand side) and means (the supply side) will reconcile technological, social, economic and environmental objectives. Through the use of proper production methods, technology matters to both parties. This requires that Nigeria not only considers technology in terms of capital and labor, but also examines it as a multifaceted entity involving both the public and private sectors (Oladipo & Grobler, 2020).

Nigeria is abundant in natural resources which should after over six decades of independence transcend into technological development. But the country is still far from been able to compete with other nations despite its huge natural endowment. Nigeria still has significant access gaps, with over 25 million people without access to any sort of telephone service. Despite the fact that the sector has connected 289 million lines, 199 million of which are operational. This is a huge improvement over the mere 400,000 lines supplied by the now-defunct Nigerian Telecommunication Limited (NITEL) between 1985 and 2001, just before the telecommunications revolution that gave birth to MTN, *Globacom*, *Airtel*, and *9mobile*. While many sectors of the economy have been hit hard by the COVID-19 pandemic which ravaged the world, according to the National Bureau of Statistics (NBS), Nigeria's telecommunications and information services sector remains optimistic as a driver of economic growth, contributing NGN 2.3 trillion or 14.3% of GDP in the second quarter of 2020 (Huang, 2021). The contribution of telecoms to GDP was 8% in

2015, but it has increased dramatically quarter over quarter and year over year to reach the present milestone of 14.3% in the second quarter of 2020. Today, many Nigerians can say that the online world has presented them with opportunities to do business. According to the Nigerian Communications Commission (NCC), 147 million Nigerians use the Internet. It's also worth noting that the sector's investment has surpassed USD 80 billion (Huang, 2021).

Nigeria remains mostly a consumer country. Nigeria's annual importation of IT solutions is projected to be in excess of USD 2 billion. The country's hardware industry is 80 per cent foreign-owned. The country's technological prowess remains pitiful. Nigeria, for example, has regularly ranked worst in the Global Innovation Index (GII) over the last seven years, and had not fared much better before that. Nigeria was placed 114th out of 129 economies in the 2019 GI. It was ranked 118th a year ago.<sup>5</sup>

### **Exporting Technology for Sustainable Development**

Marais, Grobelaar, and De Kock (2021) identified four components of the technology transfer strategy for Sub-Saharan Africa (including Nigeria). These policies include importing technology, upgrading the capacities of small and medium-sized businesses, strengthening technology infrastructure, and increasing the level of technological effort by large corporations (Table 2). Technology exported into Nigeria has imported capital goods that have generally played a role. To strengthen and deepen the industrial structure, it is critical to stimulate technology imports, particularly through foreign direct investment, as well as to encourage local enterprises to upgrade their skills and capacities by absorbing the firm's beneficial spillovers. Individuals in Nigeria in a matter should direct industrial policy that it will provide strong technical support to small and medium-sized enterprises. More technology transfer

would be facilitated by offering agency services for technology transfer and development, supporting training and information search initiatives, and giving assistance for management and constancy services (Mukoro, 2020). Furthermore, in order to meet the technological requirements of a more open and competitive marketplace, policies to modernize the technological infrastructure need to be developed. The quality and reach of technological infrastructure services could be critical in boosting quality, launching successful inventions, and breaking into new export markets in the future of the twenty-first century.

The Nigerian government needs to introduce policies that would help promote R&D (Dibie, 1997). As the industry progresses into more complicated technologies, R&D capability becomes increasingly important in order to assimilate foreign technology. As a result, industrial policy should be intended to encourage long-term investments in R&D, as well as the development of the necessary skill set. Lall, Navaretti, Teitel, and Wignaraja (1994) and Udo and Edoho (2000) contend that investment, production, and linkage capabilities are very important for the sub-Saharan African (including Nigerian) institutions to develop sustainable growth (see Table 2). Nigeria's investment capabilities are the skills and information it needs to find and purchase appropriate technologies, build and engineer factories, oversee construction commissioning, and begin the manufacturing process. Udo and Edoho (2000) pointed out that in most cases this task is contracted out to international consultants. As a result, the opportunity to develop investment capabilities is lost. The Nigerian government also needs production capabilities in the form of knowledge and experience. This is very imperative for them to run an operation and improve the production plants. Nigeria would go a long way if it could develop basic production capabilities such as quality control, maintenance, scheduling, and so on.

Linkage capabilities have to do with the elaborate networks of cooperative relationships with suppliers, buyers, and governments. It also requires Nigeria to have managers with the requisite level of skills to make rational

<sup>5</sup> Yusuf O., Shogbanmu S. Reigniting Growth and Sustainable Development in Nigeria // Verraki: Business Solutions for Africa. May 2021. URL: [https://verraki.africa/wp-content/uploads/2021/05/Reigniting-growth-and-sustainable-development-report\\_May-2021.pdf](https://verraki.africa/wp-content/uploads/2021/05/Reigniting-growth-and-sustainable-development-report_May-2021.pdf) (accessed: 23.02.2022). See also: (Huang, 2021).



investment decisions and improve their core managerial functions. Building administrative and management competence is a critical component of a successful technology transfer. Poor management capacity as well as a weak institutional and administrative structure continue to stymie the creation and execution of science and technology policy in Nigeria. The government servant is frequently overworked and underpaid, making it difficult to be efficient and respond quickly to changing conditions. As a vital component of capacity-building initiatives, a knowledgeable, better-trained, and motivated civil service with a performance-based remuneration structure, as well as increasing decentralization and delegation of tasks, should be built as efficiently and cost-effectively as possible. Capacity building should therefore extend to the private sector through the creation of relevant institutions, including measures to boost the role of non-governmental organizations and to enable women to fully engage in the process of technological transformation and sustainable growth (Lawal & Oluwatoyin, 2011).

Thus, upgrading management know-how among men and women in both public and private sectors will provide the needed impetus for economic growth and sustainable progress in Nigeria. Appropriate technology transfer and sustainability in Nigeria means that renewable resources must replace depleting ones. Sustainability of technology also implies improving the efficiency with which energy is used, reducing the environmental degradation caused by conventional energy production and use, and moving towards greater reliance on sources that do not produce carbon dioxide. Although this is an ambitious program for Nigeria that will involve many changes in policies and institutions; much of the technology is already available or close to commercial readiness (Gray, 2017). Over the past twenty years, great advances have been made worldwide in the development of these technologies. Nations such as Nigeria that lack well-developed energy networks are most likely to find the adoption of renewables to be advantageous. Ofori (1994) pointed out that it was of everyone's interest to ensure that renewables be used whenever practical because that would help

reduce emissions of carbon dioxide, lower costs, builds a market, improve energy reliability, and actual technologies, some important countries may benefit from policy advice to allow renewables to compete on more equal terms. Table 2 shows two approaches to sustainable technology development in Nigeria.

Table 2

#### Approaches to Sustainable Technology Transfer

Sustainable technology transfer and development	
Education in vocational, technical and managerial skills	Upgrade small and medium size enterprises
Investment capabilities	Import technology
Production capabilities	Improving the technology infrastructure
Linkages capabilities	Policies to promote research and development
Political will and diplomatic expertise	Use renewable resources

Source: (Ofori, 1994).

Before investing or expanding their technological manufacturing, entrepreneurs require a stable business climate. The first step toward reducing entrepreneur uncertainty and ensuring the stability of regulatory and institutional reforms is to include representative associations in the policy-making process. This conversation necessitates a shift of mindset on everyone's part. Policymakers must recognize the private sector's vital role and refrain from taking arbitrary acts that stifle its operations. Associations should be encouraged to participate in the regulatory and institutional reform process through structural adjustment measures that facilitate broad-based dialogue. Entrepreneurs, for their part, should learn to compete and produce efficiently on a fair playing field, where long-term success is determined by the capacity to compete and produce efficiently rather by privilege or evasion. Other government measures should include efforts to encourage new entrepreneurs, as well as efforts to retain existing economic activity and expand creative businesses. Economic growth should be channeled into particular areas as part of policies to deal with the land use component of development (Dibie, 1997; Woyo, Rukanda & Nyamapanda, 2020). The plan would also include features relevant to site acquisition and development if the state or community chooses to take a direct entrepreneurial role, for example.

Sub-Saharan African countries should consider financing and encouraging entrepreneurs in high-tech fields.

In Sub-Saharan Africa excessive bureaucratic meddling creates lawlessness. It motivates businesses to find loopholes in the regulations, causing those who follow them to lose their competitive advantage. Getting rid of onerous restrictions will help to reduce the hidden costs that many entrepreneurs face when it comes to obtaining permits and registering their businesses. Bribes are only one type of expense; long delays and convoluted procedures incur additional costs in terms of lost productivity and competitiveness. If small-scale companies are to thrive, licensing and other requirements must be thoroughly evaluated and only preserved if there is strong justification (Knapper, 2016).

Protecting young businesses from international competition with tariffs may not be the best idea; instead, the government should limit foreign investment in some sectors. Nigeria's industrial efficiency will be improved by importing from technologically sophisticated economies. The government, on the other hand, should encourage local engineers and technicians to import a foreign machine, disassemble it, study how it was built, and alter it to match local conditions. According to the product-cycle method, technical borrowing can progress from an imported product to a duplicate, which is usually of lower quality, to a gradual development, with finer grades and specialties, which come with experience and increased human and physical capital endowment. Future studies could look into how increased entrepreneurial behavior can help Nigeria's economy grow. Nigeria's competitive advantage will be shifted with this method (Mukoro, 2019). Technology export is primarily an information process among people. It provides information for improving designs or the production of goods and services. It need not involve the sale of equipment, but sales can incorporate technology transfer in the form of training and additional information to give the recipient new capabilities. Education is an important form as attested to by the thousands of Chinese students studying technical subjects in American universities (Lawal & Oluwatoyin, 2011).

Companies clone most technology export from the United States because it is often a prerequisite for sales. In addition to training, it can involve licensing for production, joint ventures, co-production, and other forms. The United States government transfers technology through access to information, assistance with regulation and other activities such as development assistance or educational programs. These efforts are seen as being in the United States' national interests because they are effective ways to promote development and cultivate political and economic ties. Significant progress toward sustainability will be made only when appropriate technologies discussed in the previous section are widely available, well understood, and advantageous compared to alternatives. To be affordable, much of the equipment must be produced in developing countries, and much of the technology is well within their capabilities. China has been a world leader in the production of small hydropower equipment. Other technologies will require technology transfer for developing countries to assimilate designs and achieve adequate quality control. In addition to the physical equipment, transfer of technical and political expertise may be necessary to create adequate environmental and energy institutions, so that appropriate selections of technology can be made. A wide variety of companies are involved with technologies appropriate for sustainability. Large, international companies are well acquainted with technology transfer. For example, the nuclear industry originated in the United States, and the technology was deliberately transferred abroad (Eckardt, 2014; Niebel, 2018; Yekini, 2014).

### Conclusion

This study explores the problem of technology development in Nigeria and looks at ways of exporting technology for sustainable development. It highlights the relevance of technology as a major driver of economic and structural transformation in Nigeria. The authors argue that in seeking technology sub-Saharan governments should endeavor to balance industrial promotion and environmental conditions in order to achieve sustainability. The

pre-independence colonial administration built the economy around extracting raw materials for European industry and private foreign interests, which caused a delay in developing a solid technological base in Nigeria. In their business interactions with Nigeria, foreign investors are neither humane nor philanthropic. They have been egoistic and selfish; preferring to prioritize their own interests over upholding high moral standards and assisting Nigeria in developing a sustainable economy. With a particular reference to the interplay of public and private investment in technology, a crucial problem lies in the persistent drain or the siphoning by foreign investors of resources away from Nigeria. The point here is that imported private technology has contributed little to technological progress in Nigeria. Another perspective is that Nigeria has failed to take advantage of previously imported superior technology to create a technology system that is acceptable to itself.

Two approaches to technology transfer and sustainable development are proposed in this study. On the one hand, Nigeria's acquisition of appropriate technologies requires education in professional, technical and managerial skills, investment, production and networking opportunities, the use of renewable energy, and political will and diplomatic experience. On the other hand, technology imports, upgrading small and medium-size enterprises, improved technological infrastructure, policies promoting research and development and the use of

renewable resources are all important factors that will enable sub-Saharan African countries to achieve technological transfer and sustainable development.

It is very important that the Nigerian government seeks to balance technological development, industrial development and environmental conditions to achieve sustainability. Enterprises begin with people; therefore, the governments in the sub-region should provide technical and vocational training for their citizens. Future development policies must acknowledge that while governments can help, people are the ones who make things happen. The Nigerian government also needs a healthy business climate that allows it to prepare for the future, rewards efficiency and encourages entrepreneurs to invest in themselves and their businesses. They require financial and information systems that provide access to resources, as well as infrastructure that enables them to connect to the rest of the economy and organizations that promote human resource development. Donors can make a significant contribution to these efforts by working with governments and local organizations to enhance business and encourage entrepreneurial capacity. In addition to physical equipment, technology transfer and policy expertise may be needed to create adequate environmental policies and institutions, so that appropriate technology choices can be made in the future.

Received / Поступила в редакцию: 22.02.2022

Revised / Доработана после рецензирования: 13.03.2022

Accepted / Принята к публикации: 18.04.2022

### References / Библиографический список

- Adebifa, A. (1990). *Technology policy in Nigeria*. Ibadan: NISER Publications.
- Biggs, T., Shah, M., & Srivastava, P. (1995). *Technological capability and learning in Africa enterprises*. Washington, DC: The World Bank.
- Dibie, R. (1997). Business — government relations and technology development in Nigeria. *Journal of Developing Societies*, 13(2), 195—207.
- Eckardt, M. (2014). The impact of ICT on policies, politics and polities: An evolutionary economics approach to information and communication technologies. *Andrassy Working Paper Series*, (32), 1—19. Retrieved from <https://www.andrassyuni.eu/pubfile/de-223-awp32eckardtfinal.pdf>
- Gray, S. L. (2017). The social construction of time in contemporary education: implications for technology, equality and Bernstein's 'conditions for democracy'. *British Journal of Sociology of Education*, 38(1), 60—71. <https://doi.org/10.1080/01425692.2016.1234366>
- Huang, Y. (2021). Technology innovation and sustainability: Challenges and research needs. *Clean Technologies and Environmental Policy*, 23, 1663—1664. <https://doi.org/10.1007/s10098-021-02152-6>

- Ihonvbere, J. O. (1994). *Nigeria: The politics of adjustment and democracy*. New Brunswick: Transaction Publishers.
- Knapper, C. (2016). Does educational development matter? *International Journal for Academic Development*, 21(2), 105—115. <https://doi.org/10.1080/1360144X.2016.1170098>
- Lall, S, Navaretti, G. B., Teitel, S., & Wignaraja, G. (1994). *Technology and enterprise development: Ghana under structural adjustment*. London: Palgrave Macmillan. <https://doi.org/10.1007/978-1-349-13925-5>
- Lall, S. (Ed.). (1999). *The technological response to import liberalization in Sub-Saharan Africa*. London: Palgrave Macmillan.
- Lall, S., & Wangwe, S. (1998). Industrial policy and industrialization in Sub-Saharan Africa. *Journal of African Economics*, 7(1), 70—107. [https://doi.org/10.1093/jafeco/7.suppl\\_1.70](https://doi.org/10.1093/jafeco/7.suppl_1.70)
- Lawal, T. & Oluwatoyin, A. (2011). National development in Nigeria: Issues, challenges and prospects. *Journal of Public Administration and Policy Research*, 3(9), 237—241.
- Lipumba, N. H. I. (1994). *Africa beyond adjustment*. Washington, DC: Overseas Development Council Series.
- Marais, R.; Grobbelaar, S. S., & De Kock, I. H. (2021). Healthcare technology transfer in Sub-Saharan Africa: Conceptual framework evaluation. *IEEE-Transactions on Engineering Management*, 1—17. <https://doi.org/10.1109/TEM.2021.3109445>
- Mukoro, A. (2019). *Public administration: Practice and theory in Nigeria*. Ibadan: Ababa Press Ltd.
- Mukoro, A. (2020). *Administration of the public service*. Ibadan: Ababa Press Ltd.
- Niebel, T. (2018). ICT and economic growth: Comparing developing, emerging and developed countries. *World Development*, 104, 197—211. <https://doi.org/10.1016/j.worlddev.2017.11.024>
- Ofori, G. (1994). Construction industry development: Role of technology transfer. *Construction Management and Economics*, 12(5), 379—392. <https://doi.org/10.1080/01446199400000049>
- Oladipo, O. D., & Grobler, W. (2020). Information and communication technology penetration level as an impetus for economic growth and development in Africa. *Economic Research — Ekonomika Istraživanja*, 33(1), 1394—1418. <https://doi.org/10.1080/1331677X.2020.1745661>
- Oviawe, J. I. (2017). Fostering students' enrolment in technical education programmes through career guidance and occupational awareness. *Education Journal*, 6(4), 125—132. <https://doi.org/10.11648/j.edu.20170604.11>
- Soares, A. M., Kovaleski, J., Gaia, S., & Chiroli, D. M. (2020). Building sustainable development through technology transfer offices: An approach based on levels of maturity. *Sustainability*, 12(5), 1—22. <https://doi.org/10.3390/su12051795>
- Udo, G. J., & Edoho, F. M. (2000). Information technology transfer to African nations: An economic development mandate. *Journal of Technology Transfer*, 25, 329—342. <https://doi.org/10.1023/A:1007886908690>
- Wangwe, S. M. (Ed.). (1995). *Exporting Africa: Technology, trade and industrialization in Sub-Saharan Africa*. London: Routledge.
- Woyo, E., Rukanda, G. D., & Nyamapanda, Z. (2020). ICT policy implementation in higher education in Namibia: A survey of students' perceptions. *Education and Information Technologies*, 25(5), 3705—3722. <https://doi.org/10.1007/s10639-020-10118-2>
- Yekini, N. A. (2014). *Information communication technology: Concepts and application*. Lagos: Hasfem Publishers.

**About the authors:** *Oghuvbu Ejiroghene A.* — PhD Student, Department of Political Science and International Relations, Covenant University; ORCID: 0000-0003-1422-3806; e-mail: [augustine.oghuvbupgs@stu.cu.edu.ng](mailto:augustine.oghuvbupgs@stu.cu.edu.ng)  
*Gberevbie Daniel E.* — PhD, Professor, Department of Political Science and International Relations, College of Leadership Development Studies, Covenant University; ORCID: 0000-0002-3958-2699; e-mail: [daniel.gbervbie@covenantuniversity.edu.ng](mailto:daniel.gbervbie@covenantuniversity.edu.ng)  
*Oni Samuel O.* — PhD, Associate Professor, Department of Political Science and International Relations, College of Leadership Development Studies, Covenant University; ORCID: 0000-0003-3513-0844; e-mail: [Samuel.oni@covenantuniversity.edu.ng](mailto:Samuel.oni@covenantuniversity.edu.ng)

**Сведения об авторах:** *Огубву Эджирогене А.* — аспирант департамента политической науки и международных отношений Университета Ковенант; ORCID: 0000-0003-1422-3806; e-mail: [augustine.oghuvbupgs@stu.cu.edu.ng](mailto:augustine.oghuvbupgs@stu.cu.edu.ng)  
*Гберевбие Даниэл Э.* — доктор наук (PhD), профессор департамента политической науки и международных отношений Университета Ковенант; ORCID: 0000-0002-3958-2699; e-mail: [daniel.gbervbie@covenantuniversity.edu.ng](mailto:daniel.gbervbie@covenantuniversity.edu.ng)  
*Они Самуэл О.* — доктор наук (PhD), доцент департамента политической науки и международных отношений Университета Ковенант; ORCID: 0000-0003-3513-0844; e-mail: [samuel.oni@covenantuniversity.edu.ng](mailto:samuel.oni@covenantuniversity.edu.ng)