



Sustainable Use of Natural Resources for the Advancement of Vocational Education

Dr. Daniel Ewuga Asele
*Industrial Training Fund (ITF),
Kaduna Area Office, Kaduna, Nigeria.*

Abstract

This paper focuses on how naturally endowed resources can be used to advance Vocational Education within an economy. The concept of advancement discussed is in the context of increased accessibility of specific knowledge and skills required along the value and supply chains of natural resources that is sustainable even beyond a particular phase and industry/sector. It also highlights the socio-economic impact of natural resources and its relationship with vocational education. The paper also underscores the importance of diversification to the advancement of Vocational Education as it increases the demand for skills and presents opportunities to stakeholders to develop and implement a robust approach that will drive newly discovered sector while increasing the competency level of human capital. Limitations of the current approaches to vocational education advancement discussed include too much focus on the development of requisite skills in exploitation phase of natural resources and the lack of consideration to the comparative advantages within an economy in terms of the natural resources that abound. To eliminate these limitations, new systematic approach that prioritises requisite skills along the entire value chain and phases of any natural endowment that will fit into employment opportunities with long life cycles are recommended.

Keywords: *Natural Resources, Vocational Education, Advancement, sustainability, diversification*

Introduction

Generally, natural resources are naturally existing endowments such as minerals, forest, water bodies, land and other exhaustible and inexhaustible reserves that have significant economic use either in their raw or partially processed state. There have been debates on the acceptable definition of the term “natural resources” with respect to scope. For example, Flavin (2012) defined natural resources to include “all resources” that exist in natural state and all systems that are or can be useful to man in the actual technological, economic and social circumstances. On the other hand, the World Trade Report (2010) defined natural resources as “stocks of materials that exist in the natural environment that are both scarce and economically useful in production or consumption, either in

their raw state or after a minimal amount of processing”. Both definitions have “economic importance” as a common qualifier but the later limits the definition to extractable resources such as minerals while the former has a broader scope that includes both extractable and immovable resources such as water bodies and land. The scope of definition of natural resources in this paper is same as Flavin’s. Natural resources are not only limited to naturally existing economic commodities that can be stocked and transported for exchange. It also includes all resources that are immovable (e.g. land, sea, climate and scenery) but still have economic value.

Going by this definition, natural resources are generally classified as renewable or non-renewable resources. Renewable resources include solar energy, wind or air (wind energy), water (hydro energy), land for agriculture and forest while non-renewable resources are hydrocarbon or fossil fuel, iron ores, gold, uranium and other mineral deposits. These resources are gifts to mankind from Mother Nature because they originate and exist without any human influence, yet they influence man in all ramifications. Every activity of man, economic or otherwise, is centred on natural resources. They form the basis of every human endeavour such as Construction, Manufacturing, Health, ICT, Agriculture, Tourism and many others. Developed Nations such as the United States, Finland and China based their development on their natural resources. They leveraged on the existence and abundance of these natural resources for economic growth and development by exploring the opportunities that lie not only in exportation but in using them as raw materials in their manufacturing processes, sources of food and tourism sites. Over time, they have developed and mastered the techniques involved in using natural resource in whatever form by developing the required skills set among their population.

Skills development is geared towards how natural resources can be transformed into a finished product that can easily be consumed. Raw materials used to manufacture equipment, machines and other consumables in different sectors emanate from nature. Food in its processed or raw form and water bodies that connect continents and countries through which man navigates the world are all from nature. Suffice to say that, throughout history, natural resources have been deployed by man to achieve great feats and can be used to advance every course purposed by mankind, but with special knowledge and skills set. This skills set is not just inherent in people. They are developed over time through practice, well-structured training such as vocational education and training (VET) and/or informal training.

Vocational Education (VE) is a training that seeks to impart knowledge and skills required to carry out specific job/work. It has been identified as the primary and most popular means of acquiring knowledge and skills needed in industries. Considering the demand for skills in the economy of natural resources, VE can therefore be advanced by leveraging on the naturally endowed resources within a particular economy.

From a global perspective, social and economic developments are increasingly driven by the advancements and application of knowledge. That knowledge and by extension skills can only be acquired through quality vocational and technical education programmes (Onwukwe, Chukwumeka S. O; Ibe, Chinedu; Okonmah, Dinma P. 2015). Specific knowledge and skills are required to drive economy that is based on natural resources. Many developing countries have economies centred on Natural Resource-Intensive Industries (NRIIs) (Santos, 2019). They are often dependant on the most profitable and abundantly available mineral resource for revenue, which



makes them a mono economy. As is often the case, most of these countries focus more on exporting their mineral resources leaving the local manufacturing sector that requires the mineral as inputs and has the potential to create jobs to suffer. Exportation of raw natural resources alone cannot drive sustainable growth and development within an economy as it robs the people of the opportunity to acquire and develop skills required within the value chains of the natural resources found within their locality thereby leaving a significant number of the population unskilled and unemployed, consequently affecting the gross domestic product (GDP) of the particular economy. An example of this can be seen in the Nigerian economy which ranks 10th in the global oil reserves ranking ((8th among OPEC members) with about 37million barrel proven crude oil reserves, 5,761 billion cubic meter of proven natural gas reserves and depends on the Oil and Gas export for over 80% of its revenue but has witnessed very slow economic growth and GDP. As economic historians have rightfully observed, over dependent on one commodity or sector/industry in such an economy has hindered an all-inclusive growth as factors such as regional and state instability, international trade policy and global market volatility/price fluctuation often affect the economy drastically.

Also, while some of the countries endowed with natural resources are prospering socio-economically, many still have underperforming economies with majority of their population living below the poverty line as evident in most third world countries with large mineral deposit. Although there has been an argument about whether or not natural resources have a positive effect on economic growth, history shows that most resources dependent economies often see disappointing growth. Overdependence on these resources have slowed down growth in other sectors which aggregates to an overall negative growth. Many have identified wide knowledge and skills gap especially in the area of technological advancement, among others, as the factor responsible for the set back. . Evidence from eight African countries—Angola, Botswana, Gabon, Ghana, Nigeria, South Africa, Tanzania, and Zambia— and six sectors (copper, diamonds, gold, oil and gas, mining services and timber) shows that skills, and the institutions that affect firm- and sector level capabilities, constitute the most important determinant of economic benefits (World Bank, 2014). In the light of this challenge, there have been calls in many fora for the need for economic diversification.

Economic diversification refers to the variations in the economic status or the use of a broad range of economic activities in a region or country. Diversification is used as a strategy to encourage positive economic growth and development (Wikipedia.org). This growth and development cannot just happen without a human capital component. It is the human capital that drives whatever economic activity that is aimed at improving the socio-economic life of a nation's populace. Economies with successful diversification story such as Chile, Brazil and Malaysia succeeded because they narrowed the knowledge and skills gap in the new areas diversified into. They built the requisite capabilities of the workforce that will man every activity in that sector. The success stories of these countries have proven that every diversification must be supported by a highly competent manpower.

The call for diversification cannot be ignored as it can be used to further advance vocational education, especially diversifying within the extractive industry which seeks to tap the existing natural resources and process into finished goods. However, diversification cannot yield the required result if the problem of knowledge and skills gap is not addressed in *pari passu*.

This paper focuses on how naturally endowed resources can be used to advance vocational education. Advancement in this context refers to increased accessibility of specific knowledge and skills required along the value and supply chains of natural resources that will be sustainable even beyond exploitation period, with a visible transformation of lives. It also seeks to escalate the connection between mineral resources and vocational education within an economy. This paper also recommends that diversification presents opportunities to stakeholders to develop and implement a robust approach that will drive newly discovered sector while increasing the competency level of human capital beyond the particular industry.

Natural Resources and their Socio-Economic Impacts

Natural resources are unevenly distributed across the globe. While some are more endowed than others, every nation has an iota of natural resource either in a renewable or non-renewable form. However, through trade relations between countries, the international community has tried to ensure redistribution as there exist an economic interdependency amongst them. Imbedded in the trade relationships where these natural resources (raw or processed) are exchanged for revenue, are activities that require skills and knowledge for optimal efficiency.

The United States has the world's largest coal reserves with 491 billion short tons accounting for 27% of the world's total. Australia is the world's largest net exporter of coal accounting for 29% of global coal exports (world factbook, www.CIA.gov). According to Worldatlas, in 2015, the country's total metals and coal reserves were valued at \$109.6 billion. It is known as the leading producer of coal for decades now, and currently controls over 31% of the global coal reserves and a significant amount of timber. The total natural resources in the country are valued at \$45 trillion with over 89% of them being timber and coal. The United States has a sizeable deposit of copper, gold, oil and natural gas. As at January, 2020 the mining industry alone is said to have employed over 600,000 people directly according to the U.S Bureau of Labour Statistics' report.

The country has also succeeded in turning some of its natural resource into tourism sites which has generated employment and a significant amount of revenue. Data from the United States' National Travel and Tourism Office shows that the U.S. travel and tourism industry generated over \$1.6 trillion in 2017, supporting 7.8 million U.S. jobs (both direct and indirect). Travel and tourism exports accounted for 11 percent of all U.S. exports and nearly one third (32 percent) of all U.S. services exports (www.travel.trade.gov). None of these would be possible without skilled and knowledgeable workforce.

China, which is the second largest economy in the world is said to have large natural resources with an estimated worth of \$23 trillion. With an approximated total area of 9.6 million square kilometres, the country has commercial quantities of different mineral resources with coal and rare earth accounting for ninety percent of its natural resource worth (Samantha, 2020). It is also endowed with other renewable resources such as water, land and forest which it has leveraged upon to attain its present level of growth and development. The highly industrialized and diversified economy is mainly powered by naturally existing sources of energy, especially water and has the much-needed competent human capital to run it as it has reinvested proceeds from the natural resources into human development. China has succeeded in improving the vocational education sector to service different



sectors of its economy with the requisite knowledge and skills in technological transformation and entrepreneurship.

The African continent extends over an area of approximately 30 million km², representing about 20% of the Earth's total land area (Robert, 2016). It has a comparative advantage that when leveraged upon, can stimulate an unprecedented sustainable growth and development. The region is home to the world's largest arable landmass; second largest and longest rivers (the Nile and the Congo); and its second largest tropical forest. The total value added of its fisheries and aquaculture sector alone is estimated at USD 24 billion. In addition, about 30% of all global mineral reserves are found in Africa. The continent's proven oil reserves constitute 8% of the world's stock and those of natural gas amount to 7%. Minerals account for an average of 70% of total African exports and about 28% of gross domestic product (AfDB, 2016).

The continent is resource-rich, hosting 30 percent of the world's total hydrocarbons and mineral reserves; 12 percent of its crude oil reserves; well over a third of its bauxite, gold, uranium and chromite; 88 percent of its diamonds; and 95 percent of its vanadium (World Bank, 2014). Despite these abundant resources, the continent has not witnessed an economic growth that matches its potential. Several factors such as Conflict, low technological advancement, shortage of specialized skills and lack of policy direction are responsible for the stunted growth in the continent. Revenue from natural resources has affected social, economic and political development in many countries. Most important is how it directly affects the knowledge and skills base of the economy which is evident in the global unemployment data.

Natural Resource and Vocational Education

As earlier stated, and going by the context of the definition of natural resources in this paper, no nation is without an iota of natural resource of some sort. Translating these endowments into productive ventures that will result in significant all-inclusive economic growth and development is often the challenge. Vocational Education has been identified as a tool to overcoming this challenge. Vocational Education is a part of an educational system that imparts specialized knowledge and skills required for a certain profession or work. It involves hands-on or practical application of theoretical knowledge. Its application cuts across every sector, ranging from manufacturing, agriculture, extractive industries, construction to telecommunication. A nation that has a robust Vocational Education system will have adequate highly skilled human capital to service the various sectors of its economy. Naturally endowed nation cannot maximise its potential if there is no highly competent manpower to transform its resources.

The ability of a country to exploit its resource base depends critically on the nature of the learning process involved (Jean, 2015). When this process is left disorganised, non-specific or without direction, application and advancement of knowledge and skills can never be effective. This often results in low productivity of the population. It is true that developed economies have paid attention to human capital development through Technical Vocational Education and Training (TVET), but their efforts in this regard are not arbitrarily. They are systematic and based on well informed policy decisions that are consistent with their strength with respect to most prevalent natural endowments. A good example of a successful economy that has an organised learning process that leverages on natural resource is the Finland economy. With a population of about 5.53

million people, the country ranked second in the world in education and training according to the 2017 human capital index ranking of world economic forum. Finnish students rate number one in the world in science and mathematics. In spite of its remoteness, relative scarcity of natural resources, smallness of the home market and recent history characterized by wars and social cleavages, Finland transformed itself from an agriculture-based economy in the 1950's into one of the leading innovation-driven, knowledge-based economies and high-tech producers in the twenty-first century (World Bank, 2014). Specialised knowledge and skills are primarily obtained through TVET or VE. However, types of knowledge and skills to be developed in an economy depend on the available resources and comparative advantage within that economy.

Natural resources are exchanged either in raw or processed form. Changing them from one form to another entails high level of skills in the transformation process. Envisage a spectrum upon which exploration is at one end, exploitation or production and transformation at the intermediate, while consumption is at the other extreme. Each of these phases has its requisite skills with some being transferable from one phase to another or even outside a particular sector. A country that is rich in mineral deposit should have a reasonable section of its population competent in most of the required skills in exploitation, processing and even the economy of that resource.

As a tool for productivism (Anderson, 2008), vocational education can be further advanced when skills required within the entire value chain of natural resources are identified with the purpose of gearing an educational system's curriculum towards developing and supplying such skills. In most developed economies where expatriates are often drawn into emerging economies that are natural resources dependent with common competitive advantages, skills are developed through effective vocational education systems and years of experience.

As with the extractive industry, many other Natural Resource-Intensive Industries are capital intensive with high risk, making them to require great level of competency in specialised skills that can only be attained through the advancement of vocational education. Advancement does not only require that part of the proceeds from these sectors be reinvested into vocational education sector as is the common practice but that vocational education be integrated into the investment portfolios of every project in the sector.

Diversification and Vocational Education

Since economic diversification is a strategy for economic growth and development and economic growth is highly dependent on human capital development, diversification undertakings offer opportunities for the advancement of vocational education. As earlier stated, diversification project cannot be effective or successful without a competent workforce. According to Fruman, 2017, diversification broadens the range of distinct products an economy produces and exports or increases the number of overseas markets it exports to. This involves introduction or creation of new economic activities. When this happens within an economy, there is a need for skilled, semi-skilled or even unskilled labour in that new sector. Along the entire value chain of the newly introduced sector is a huge demand for expertise of different categories.

The 2017 World Economic Forum's global human capital report indicates that the human capital development gap is largest in South Asia and Sub-Sahara Africa which are emerging economies. This, by implication, means that even when the pathways to diversification are pursued, there are no



adequate and quality manpower to kick-start the projects or even sustain it. The emphasis on skills diversification in vocational education system is therefore necessary in these economies.

As an economy is diversifying, its educational system should also diversify along same line because of the increased demand for skills in current technological trends. There ought to be diversity of fields of study at all levels of the education system to meet this demand. The vocational education sector which cuts across the various levels (secondary and tertiary) of overall education system as well as the informal VE sub-sector will have to stand up to the challenge to supply the much-needed skills to the particular industry.

Hindrances to Sustainable Use of Natural Resources for Vocational Education Advancement

The joint flagship report by the African Development Bank in conjunction with Bill & Melinda Gates foundation (2016) states that natural resource discoveries are often followed by high expectations about local employment opportunities – but experience shows that there is no guarantee that projects will or can, employ many locals. Contrary to expectations, only a few locals get to be employed because majority do not have the competencies required to fit in as projects are often new to them and they have not gone through any related training. Greater skills capacity enables higher levels of local employment and local procurement, in turn promoting inclusive growth and community empowerment (World Bank, 2014). Businesses are forced to source for competent people overseas. With a change of approach this wide skills gap can be narrowed to the barest minimum.

Exchanging natural resources in their unprocessed form for revenue or income only, does not result in significant economic growth and development as evident in most resource-based economies, bearing in mind that economy growth and development is a function of a skilled, engaged and productive population. It limits the kind of specialised skills developed in a vocational education system to only requisite skills in the exploitation phase and is a major hindrance to the advancement of vocational education. While it is important to develop skills required in exploitation of natural resources, it is crucial to also develop the skills required in their processing as it offers multiple options of usage and further increases the number of new skills to be developed as well as accessibility to locals. Exploration, exploitation and transformation stages of natural resources are breeding grounds for new knowledge and skills improvement.

Also, it is imperative to note that the current approach adopted by most vocational education stakeholders is generic. It does not incorporate peculiarity in geographical and geological formations and mineral deposits within a region. Some of the acquired skills do not have economic viability within that region and so cannot be applied. Vocational education centres/schools are not established in close proximity to natural resources extraction points such as mining sites, processing companies and areas where renewable resources are converted for other purposes like energy. This remoteness has made access to onsite equipment and the extracted natural resource difficult, thereby preventing proper exposure to real work scenarios in vocational education programmes considering the capital-intensive nature of practical equipment.

Another hindrance to the sustainable use of natural resources for vocational education advancement is lack of consideration to the life cycles of employment opportunities that abound in natural resources related venture when designing vocational education system. Every natural

resource project has the potential to generate employment - direct, indirect and induced - from the exploration stage to consumption. Most of the skills be offered in the system are only needed in a phase of the project which makes it applicable in short term employment opportunity. Others are applicable to all the phases and even outside the project/sector which translates into long term opportunity. Attention is often focused on the skills that are needed in the short-term opportunity leaving the ones that could be applied in all the phases and could result to long term employment opportunity. This also broadens the skills gap in within the economy.

Conclusion and Recommendation

Significant milestone can be achieved in the advancement of vocational education if available natural resources are deployed efficiently. Understanding the science and technology involved in the exploitation, conversion and consumption of these resources and imparting the related knowledge and skills to people will enhance their productivity and improve overall economic prosperity. Most of the skills acquired will definitely outlive the specific economic activities for which they were acquired for. Integrating specialised knowledge and skills acquisition into every business that seeks to exploit or process existing natural resources will further advance the course of Vocational Education.

Lastly, although there are mounting concerns that global natural resources, especially non-renewable, are depleting in quantity due to indiscriminate exploitations, history shows that commercial quantity of mineral deposits can last for over a generation. It also takes a generation to have a visible and sustainable economic growth and development as seen in China, Chile, Malaysia and Finland. Therefore, the opportunity that abounds for vocational education in the use of natural resources for its advancement can last for over a generation with the ripple effects being visible progressively within the period that the resource will last and even beyond. With an unwavering focus on the enhancement of transferable skills, there is a window of opportunity for the advancement of vocational education when natural resources are converted into sustainable economic activities for long-term social and economic benefits.

For an effective and sustainable use of natural resources for the advancement of vocational education, the following recommendations are made:

- i. Vocational education stakeholders should as a matter of urgency and utmost importance review existing curriculum to cover requisite skills in the entire value and supply chains of the areas of comparative advantage within their respective economies.
- ii. As the regulator and coordinator of economy, Government whose responsibility it is to ensure an all-inclusive growth and development, should make legislations that will mandate companies to include establishment of vocational education centres within close proximity to exploitation and processing sites in their investment plan. This will provide better exposure and more access to vocational education and equip them with the prerequisite skills for natural resources project as well as increase their employability. The vocational education centres can be funded through counterpart funding.
- iii. In designing a vocational education programme, stakeholders should identify skills that are required in each of the stages of natural resource ventures and lay emphasis on



those that are applicable in at least two or more phases and even outlive the project live span.

- iv. Economic diversification feat should be pursued vigorously and every economic diversification plan should include a vocational education component that will involve the education sector at the conception stage as well as other stakeholders so as to reduce the skills gap when the project becomes operational.

References

- Africa Development Bank & Bill & Melinda Gates Foundation (2016), Flagship Report: Delivering on the promise: Leveraging natural resources to accelerate human development in Africa, Paper Series, Paper 7: Leveraging extractive Industries for Skills Development to Maximize Sustainable Growth and Employment. Retrieved from www.NaturalResourcesForHumanDev.org
- African Development Bank (2016), Catalyzing Growth and Development Through Effective Natural Resources Management- African Natural Resources Center Brochure. Retrieved from www.afdb.org
- Anderson, D. (2008), Productivism, Vocational and Professional Education, and the Ecological Question. *Vocations and Learning* 1, 105-129. <https://doi.org/0.007/s1218-008-9007-0>
- Bureau of Labour Statistics, Current Employment Statistics - CES (National), 2020. Retrieved from <https://www.bls.gov/ces/>
- Geoffrey Migiro, Countries with Most Natural Resources, 2018, Worldatlas, www.worldatlas.com
- Flavin, C. (2012), *Starea lumii (The world state)*, Edit. Tehnică, București, Romania
- Fruman, C. (2017), Economic diversification: A priority for action, now more than ever. Published on Private Sector Development Blog March 01, 2017. blogs.worldbank.org
- Jean, P. (2015). *Natural Resource Abundance and Economic Growth Revisited*, Department of Economics Northeastern University, 301 Lake Hall, Boston MA 02115-5000, USA
- National Travel and Tourism Office, <https://travel.trade.gov>
- Onwukwe, Chukwuemeka S. O; Ibe, Chinedu; Okonmah, Dinma P. (2015). Technical and Vocational Students' Attitude towards Palm Kernel Oil Extractive Industries in Government Technical Colleges, Enugu. *International Journal of Education and Evaluation*, 1(8), 95-104. Retrieved from www.iiardonline.org
- Robert, F. (2016), Mineral Deposits of Africa: A Compilation (1907–2016), 12, *Society of Economic Geologists Journal*.
- Samantha, W. (2020). *Natural Resources in China - Statistics & Facts*. Retrieved from www.statista.com
- Santos, C. (2019). Building Capabilities in Natural Resource-Dependent Economies: An Innovation Systems Analysis of the TVET programme in Guyana. *International Journal of Innovation Studies*, 3(1) Pages 1-11. Retrieved from <https://www.sciencedirect.com>
- Wikipedia.org, Economic Diversification.
- World Trade Report, 2010. Trade Natural Resources, WTO, Geneva
<https://doi.org/10.30875/65678d0b-en>

- World Bank (2014). *Human Capital for the Oil, Gas, and Mineral Industries (English)*. Science, Technology, and Skills for Africa's Development. Washington, D.C. World Bank Group. <http://documents.worldbank.org/curated/en/406101468202451878/Human-capital-for-the-oil-gas-and-minerals-industries>
- Halme, K; Lindy, I; Pirrainen, K, A; Salmaine, V; White, J. (2014), Finland as a Knowledge Economy 2.0: Lessons on Policies and Governance. Directions in Development –Science, Technology, and Innovation;. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/17869>
- World factbook, 2018, Field Listing: Natural Resources. www.cia.gov
- World Economic Forum (2017), The Global Human Capital Report 2017 Preparing people for the future of work. <https://www.weforum.org/reports/the-global-human-capital-report-2017>