

# Impact of COVID-19 on Oil and Gas Sector in Nigeria: A Condition for Diversification of Economic Resources

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## Abstract

A plethora number of literature advocates for economic diversification in Nigeria in order to address its socio-economic challenges. The advent of the COVID-19 pandemic has exemplified this viewpoint even further, as it has had a severe impact on many parts of the Nigerian economy while the federal government scrambles for revenue to fulfill national expenses. However, observation reveals that little attention is paid to the influence of COVID-19 on the oil and gas sector, despite the necessity to diversify economic resources for human capital development. The purpose of this research is to investigate the influence of COVID-19 on the Nigerian oil and gas sector. Problems are recognized and solutions are proposed through the textual analysis of literature. According to the research, COVID-19 has a negative influence on the oil and gas business in Nigeria due to Nigeria's overreliance on oil resources as a key source of national revenue, among other issues. As a result, the study emphasized the need for and importance of diversifying the nation's economic resources by focusing more attention on sectors such as SMEs that are aided with protection and promotion, as well as the agricultural sector, which incorporates technology and scientific input as a driving force for improvement. If adopted, diversification will address numerous difficulties such as poverty, which affects the majority of inhabitants, unemployment, mounting foreign debt, and the massive importation of products and services into the country due to a lack of economic diversification. According to the report, the Nigerian government should invest extensively in small and medium-sized firms (SMEs) and agricultural investment in order to overcome the economic challenges caused by COVID-19's detrimental influence on the economy.

## Keywords:

COVID-19;  
Oil & Gas;  
Economic Diversification;  
Small and Medium Enterprises (SMEs);  
Agricultural Investment.

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## 1- Introduction

The outbreak of the COVID-19 virus in China has largely affected the global economy due to its widespread health and social effects and its speed of contagiousness. Effects that have subjugated the world economy to an unprecedented challenge, inflicting a health crisis and spawning economic hardship at an enormous cost [1]. This crisis has also culminated in the fall in oil prices, which upsets the economies of countries that largely depend on oil as an international commodity [2]. Furthermore, the supply chain was equally disrupted as the movement of goods and services was tremendously curtailed since China remains the world's largest producer and producer of consumer goods, creating a disequilibrium in the global commodity market with a negative effect on the demand for oil in the global market. This also includes the halt in international and cross-countries travel as people were confined to their homes globally. Indeed, a great challenge with its effect on the economy largely unpredictable with its shock likely to remain for a longer period could result in a major structural change in the global economy for oil-producing nations [3].

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The problem statement of the study is that on March 6, 2020, during the OPEC meeting in Vienna, which was before the enormous widespread of the COVID-19 pandemic, Russia and Saudi Arabia engaged in an oil price competition that affected the price of oil in the global market with a significant effect on oil-dependent economies such as Nigeria, Venezuela, Angola, and Iran, among others. The oil price thereafter fell by 30%, which was the highest loss recorded since the aftermath of the Gulf War in 1991 [4]. Although the price of oil later rebounded after the OPEC communities reached an agreement to cut down the amount of production. However, for nearly three decades, it has been reported that this is the first major hit with global magnitude, being the sharpest one-day oil price crash observed. By March 2020, the price of Brent oil had fallen from \$34 per barrel to \$25.70, recording a 24% decline [5]. Furthermore, as a result of the high economic volatility and uncertainty, by February 2020, the global stock markets underwent a loss of about \$6 trillion in wealth. At the same time, the S&P 500 index also accounted for a loss estimated to be around \$5 trillion [6]. This, with the absence of unnecessary emphasis, is enough evidence that the global economy was badly hit by COVID-19, especially in relation to the production and price of oil and the performance of the stock market. Therefore, Nigeria, as an active member of OPEC, needs a diversification of its economy to cushion the unprecedented loss in foreign earnings due to the sudden pandemic breakout of COVID-19. Nevertheless, it is necessary to investigate the need for diversification of the economy via the launching of investment in agriculture and overhauling of the SMEs to prevent catastrophic damage that could ground the Nigerian economy to a zero level.

According to the OPEC Secretariat, between May and June 2020, with regards to the assessment of oil storage capacity that is available globally, it was recorded to be above one billion barrels. In the wake of the overwhelming gap in demand and supply, there was a record of an estimated excess volume of 14.7 mb/d. Globally, as a result of the oversupply, there would be an additional 1.3 billion barrels added to crude oil stocks, and hence exhaust the available global crude oil storage capacity within that period, as mentioned earlier. Further, the OPEC Reference Basket fell in April to \$20/b from \$52.7/b in March 2020, a decline of around 70%, resulting in a tremendous fall in revenue, especially for major oil exporting countries.

For those economies that heavily depend on oil, the emergence of COVID-19, which resulted in a fall in the demand and price of oil, has caused great economic havoc. In the case of Nigeria, a need for the adjustment of the budget became inevitable, because the federal government has placed its benchmarks beyond the current realities. Ultimately, the Federal Government had to make an austere decision by cutting down revenue from the exportation of crude oil against the initial plan of 2.64 trillion naira to 254.2 billion naira [7]. Thus, reducing the crude oil benchmark to \$30 per barrel as against the \$57 per barrel that was initially planned in the budget, a peak decision that was also reflected on the balance of payments accounts. Nigeria began hunting for foreign loans to bridge the gaps in current account deficits as the pandemic demanded huge investment in healthcare infrastructure and facilities, medical tools, and a reliable workforce [2].

In the wake of this reality, there is a need for an alternative economic structure from being over-dependent on oil to less dependency for Nigeria, especially since the modern economy is on the verge of transitioning to renewable sources of energy [8].

## 2- Literature Review

Most recent literature has investigated the impact of COVID-19 on the economy either at a global level (Abba Ahmed [2] and Ozili & Arun [6]) and its effect on the Nigeria oil and gas sector and its economy at a regional and domestic level [7, 9]. In addition, Baldwin & Di Mauro [3] and Amuda [10] investigated the impact of COVID-19 on economies [3]. Amuda [11] also examined the socio-economic impact of the COVID-19 pandemic in Nigeria. Furthermore, Nwoba et al. [12] also investigated COVID-19 and its effect on the fall in oil prices. A recent study by Olujobi et al. [13] also examined the case of COVID-19 more deeply from a legal standpoint in the Nigerian economy. Furthermore, Eze [14] did a comparative analysis of declining oil revenue and its implications on mono-economy budgetary objectives in Nigeria. Ogochukwu [15] also examined the oil price fall and its impact on the Nigerian economy, stressing the need for diversification. Saka & Olanipekun [16] also investigated the economic implications of human capital development and industrialization in Nigeria, while Pawlak & Kołodziejczak [17] also logically explained the role of agriculture in ensuring food security in developing countries to ensure sustainable food production. Philip-Kpae et al. [18] investigated the role of engineering and technology in agricultural development in Nigeria as catalysts for improved development of the agricultural sector. Quartey et al. [19] revealed the constraints facing financing the growth of SME's in Africa.

However, a few studies have really investigated the COVID-19 pandemic as a global issue, which demands the need to revamp the agricultural sector by the Nigerian government in the face of this challenge. This is so because the government's overdependence on oil revenue has caused a huge fiscal setback in addressing the national emergency in the case of COVID-19. This study has therefore attempted to fill this gap, particularly by paying attention to human capital development, SMEs, and agricultural investment as a national panacea for growth and development.

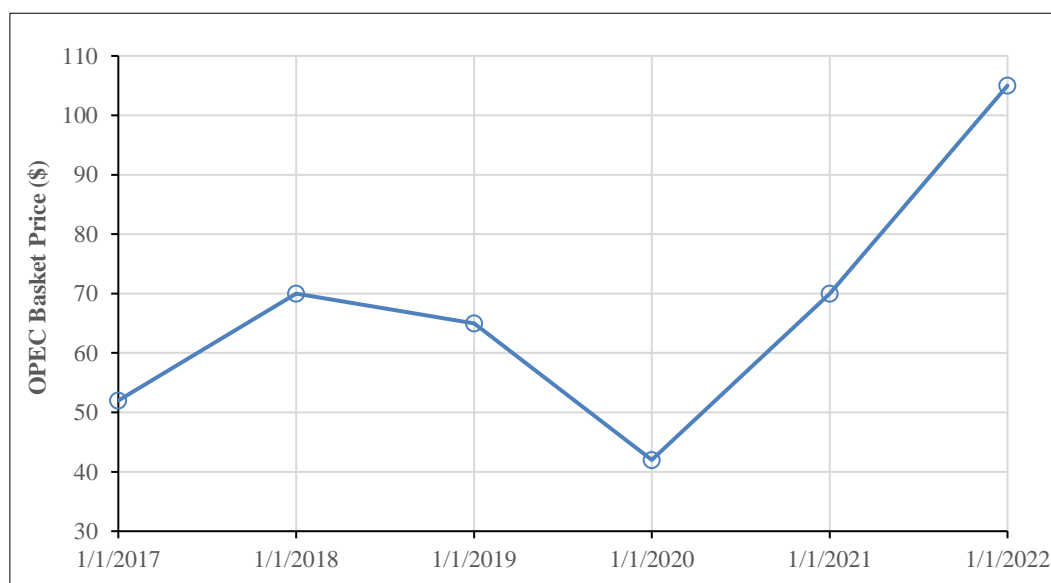
This study is divided into six sections. Section one discusses the background, problems, and a brief literature review of the study. Section two focuses on the main subject, which is the impact of COVID-19 on the Nigerian oil and gas

sector. In addition, Section 3 focuses on the need for economic diversification towards human capital development engineered for national growth. The fourth section highlights how the COVID-19 pandemic has equally affected SMEs. The fifth section discusses the importance of developing the agricultural sector as a panacea for economic growth and development. The final section ends with the conclusion of the study and policy recommendations, as well as directions for future studies.

### ***2-1- COVID-19: Revisiting Its Impact on the Nigerian Oil and Gas Sector***

Nigeria is one of the leading nations among oil-producing countries. It is the sixth largest among OPEC members and the ninth largest globally. The oil and gas sector accounts for more than 90 percent of Nigeria's foreign exchange earnings. Nigeria is heavily dependent on oil as its major commodity in the international market, which has largely affected the growth and development of other sectors of the economy and caused a colossal shortfall in its economic growth with a great detriment to human capital development. With the emergence of COVID-19, the Nigerian oil and gas sector was also affected by its shock, which tremendously affected the production of oil and gas as there was a shortage in global demand. This was as a result of restrictions on the movement of people across nations and the short-down of factories in China, on which Nigeria profoundly depends upon its consumer goods, among others.

By 2020, as noted in other oil-dependent economies, due to the fall in international demand for oil and the unprecedented fall in crude oil prices, the Nigerian economy experienced a downturn in retrogression by three (3) years at the emergence of COVID-19. As a consequence, the Nigerian economy recorded a whopping loss of an estimated USD 15.8 billion. In addition, there was a 6.1% fall in the GDP between May and June and a 3.62% fall between July and September prior to a recorded rebound of about 0.1% between October and December of 2020. The GDP also declined to 1.98% due to the adverse effect of COVID-19 [20]. This is a result of the direct effect of COVID-19 on the production of oil, which also influenced the flow of demand and supply as well as the price across countries, as better illustrated in the Figure 1.



**Figure 1. Trends in the price of oil during the COVID-19 phase**

Paying attention to figure 1, we could see the sharp decline in oil prices between late 2019 and early 2020 and its potential harm to economies that have rigidly relied on oil as a source of revenue. According to Afaha et al. [7] and Gharib et al. [21], the impact of COVID-19 on the Nigerian economy can be classified into five major dimensions:

- i. Shock in oil demand contributing to the decline in the price of oil;
- ii. National budget;
- iii. Stock market shock;
- iv. Inability of borrowers to service loan;
- v. Supply chain disruption.

It is also asserted that the COVID-19 pandemic will affect Nigeria's oil and gas sector in the following aspects: i) low rate of demand for oil resulting in loss of revenue for Nigeria (bringing about excessive supply with less demand for crude oil in the international market); ii) high level of pressure on foreign reserves and the naira with the fall in the sale of oil and gas; iii) scarcity of buyers; iv) DPR declaration of force majeure; v) cutting down on costs with a resultant

effect on projects and the workforce due to the fall in the price of oil and gas; and vi) pump price review among major marketers [21].

Furthermore, another major contributing factor to this drastic decline in the production of oil in Nigeria prior to the COVID-19 pandemic was that a forecasting period between 2015–2018 pointed to a major decline of 7.93% in the production of oil. This was a result of market forces and their reaction to the increase in investments in both the downstream and upstream sectors of the Nigerian oil & gas industry. In addition, the incessant challenge in the production of oil and gas can be attributed to the negative effects of oil and pipeline vandalism for a few decades in the past and the common militant attacks on oil and gas infrastructures. Additionally, oil theft remains one of the major issues the Nigerian oil & gas market is experiencing; as a consequence, resulting in large amount of operational losses for oil and gas firms in the country [22]. Relative to that is the decline in the price of oil, with a recorded level of about \$22/b with an apparent negative effect on revenue. Further, the volatility in the demand for oil, which has a direct effect on price, is also a major factor in the oil and gas market. Although, very small relative to the adverse effect of COVID-19. The latter has led to a huge disruption in demand and supply, with a major impact on the financial market as well, leading to rapid swings in price. It is evident that both internal and external factors affected the oil and gas industry.

In the Nigerian context, the budget for the year 2020 was drastically tailored and trimmed by the Federal Government down to 45% due to the effect of COVID-19 and its impact on the production of oil, i.e., the excessive availability of oil. Capital expenditure was also affected with a reduction of 20%, while recurrent expenditure was reduced by 25%, whereas the idea of a budget review at the state level was not adopted [23]. In search of a safe haven, the Nigerian government joined OPEC and OPEC+ to reduce the supply of crude oil to 10 million bpd in the second quarter, and between the third and fourth quarters, it was later reduced to 8 million bpd, while from the first quarter of 2021 to the early second quarter of 2022, it was reduced to 6 million bpd as a strategy to stimulate stability and short-term price.

The implication, as agreed, is that Nigeria would have to reduce the production of oil to 1.412 million bpd, 1.495 million bpd, and 1.579 million bpd, respectively. As a result of this initiative by OPEC+, it is anticipated that in the short term the price of crude oil will rebound by at least \$15/pb [7, 24]. In the long run, there is often a large effect on the production of oil & gas from an external shock of this magnitude, which necessitates the need to be economically prepared and diverse.

With further emphasis on the Nigerian oil and gas industry, despite the fact that Nigeria is endowed with enormous natural gas with a reserve estimated to be about 5.25 trillion M3, or 2.8% of the total world reserves, a huge amount of this gas is also produced alongside crude oil, whose production is challenged and greatly hurt because of insecurity, sporadic and continuous attacks on crude oil infrastructure, alongside the close-down of oil production infrastructure by international oil firms. This is also attributed to the lack and absence of infrastructure to produce gas and the lack of competitive natural gas markets, with a great amount being flared. Again, due to a lack of directed capital to acquire the necessary technologies and facilities required to convert the flared gas to commercial natural gas. Furthermore, in order to satisfy the rising domestic and international demands for gas, the Gas Master Plan was initiated by the Federal Government in 2008 to combat gas infrastructure and export short-term reserves, challenges which in some instances, gas is only available after the oil has been extracted. Another rising issue is the variance in the financial capacities of different sectors to pay for gas. The gas master plan was to enhance the viable utilization and supervision of the gas industry to boost the multiplier consequence of gas in the national economy, place the nation in a competitive and high-value export market so as to enhance the domestic gas supply, and guarantee sustainable energy security in Nigeria [8, 25, 26].

As the case may be, sustainable energy or not, in the international market, the majority of this gas (LNG), which is about two-thirds, is exported to countries like Spain, Asia, Portugal, France, and Mexico. Unfortunately, the reality for the domestic market seems to be the opposite, as gas flares continuously with little supply, which leads to a price increase in the geometric progression rate shortly after many Nigerians have overwhelmingly chosen gas as an alternative source of energy for cooking due to the scarcity and price increase of kerosene. These developments endangered the public's consumption and national revenue despite the wealth of oil and gas owned by Nigeria. The manufactured gas is then exported to neighboring states like Togo, Benin Republic, and Ghana channeled through the West African Gas Pipeline (WAGP) [27]. Diversification of economic resources to improve the Nigerian economy is imperative following the aforementioned challenges in oil and gas production, while the involvement of SMEs will also be a great success if the government's intervention is positive and timely.

The Nigerian oil and gas industry is experiencing a rhythmic and dynamic struggle that became more apparent with the advent of COVID-19, even though the Niger Delta militants had been a perennial challenge faced by the Nigerian government prior to the advent of COVID-19 as the youth engaged in oil theft and oil infrastructure vandalism because of unemployment as agitation for self-control of oil and gas. The industry, though a potential source of natural resources for economic growth, has not been feasible enough to place Nigeria where it deserves among the committee of wealthy nations due to domestic and international challenges. Nevertheless, it is necessary that the Federal Government of Nigeria embrace strategic change while the opportunity is still openly wide; otherwise, a further step into the second

half of the century might mean a lot to different economies and regions that are envisaging the global development of events. Therefore, economic diversification is always a good place to start considering the potential and colossal opportunities within several industries that could contribute immensely to national and economic growth. For a successful "paradigm shift", history has shown that nothing can be compared to human capital regarding economic development, even in the wake of competition between man and machine (Artificial Intelligence). It is human capital that determines the rate at which the economy could maintain growth [28] when expanding the knowledge and skills of the people or is responsible for its fall when knowledge and skills are stagnant.

### 3- Theoretical Perception

With the rate of estimated population growth in Nigeria, it is a must that the country diversifies its economy to set a pace for its ability to withstand sudden or unforeseen events that could result in an economic shock for the nation, such as the COVID-19 pandemic, which exerted negative forces that prevented economic, social, and educational progress in countries with inadequate institutions or that are financially weak. Rent-seeking behavior and efforts to seize accessible economic rents are frequently the focus of political activity in countries with weak economic foundations, particularly when such countries are also dependent on high-value minerals as a major source of revenue. Some of the oil-dependent countries for major revenue such as Nigeria, Venezuela, Gabon, and many others. The World Economic Forum [29] shows that Algeria, Azerbaijan, Brunei Darussalam, Iraq, Kuwait, Libya, Sudan, and Venezuela are among the nations where gasoline accounts for more than 90% of their total exports. The Natural Resource Governance Institute revealed that it was positive for those countries whose governments are dependent on these minerals, such as Burkina Faso, Guyana, and Kyrgyzstan, which depend on non-oil natural resources, such as Uranium and Gold. Because of production cuts coupled with safe-haven buying, they were able to make gains during the COVID-19 containment measure, when many nations' economic activities stood at their lowest point. When economic depression hit many developing countries.

The institutional theory, for instance, focuses on the intervention of the institution in resource-rich countries with active leadership, introducing and implementing economic policy that allows private and government partners to foster partnerships for economic development that focus mostly on people's wellbeing through a people-oriented policy. The policy, in the form of diversification, provides employment and wellbeing and prevents the emerging chaos and anarchy from restive unemployed youth or some unfortunate individuals who may be unemployed or physically challenged. The institutional theory focuses on government, organization, and the required policy rather than individuals in shaping the institution to deliver and be conscious of the needs for general growth in all sectors of the economy.

#### 3-1-Importance of Institutional Theory

Theoretical contributions about the contrasts between formal and informal institutions, regulative, normative, and cultural-cognitive types of institutions, as well as the many levels of institutions, constitute the framework for the systematic investigation of innovation. The institution became innovative to seek legitimacy in order to be accepted. Change happens as a result of institutional pressure, and this legitimacy functions as a mechanism that connects organizational behavior with belief structures and public opinion [30]. Institutions are those that are sealed off from their environment, and their examples, according to studies in sociology, are family, government, economy, education, and religion. Scott [31] found that regulative, normative, and cognitive are the three pillars of the institutional system that are central to the success of the strategies adopted by institutional entrepreneurs.

Despite compelling economic evidence supporting diversification's long-term advantages, the current situation makes it challenging to carry out crucial economic reforms [32]. Therefore, effective diversification strategies will be based on a thorough understanding of the underlying political environment, the key players and how they exercise power, the institutions that affect how power is moderated, and the potential impact of external factors, including regional partners and institutions. Institutions are spontaneous, "higher-order" forces that exist above the level of the individual that constrain or define interests and political engagement "without repeatedly necessitating collective mobilization or authoritative intervention to attain these regularities" [33].

### 4- COVID-19 and the Need for Economic Diversification Towards Human Capital Development

The last two decades have witnessed significant and tragic economic events, which is enough insight to really ponder, especially for a country like Nigeria. The emergence of the COVID-19 pandemic has also deepened the economic challenges facing the country as the government struggles to find its footing to address the spontaneous issue of revenue due to poor financial management. An issue that could lead to devastating consequences should the status quo remain the same when compared to other economies.

Studies have shown that the Asia financial crisis of 1998 [34], the 2008-2009 global financial crisis [35], the fall of the Zimbabwean currency [36], and the debt crisis of Sri Lanka [37], among other international events of economic boom and bust, are concerning issues that deserve proper attention for both developed and developing economies, giving

them an adverse effect on the internal order of the affected states and regions—a lesson to the Nigerian government [38]. Indeed, it is a great hindsight for all economies that modern capitalism makes us sick and the disease requiring states to look for a better alternative means of survival to tackle this challenge. More so, whether a state can do that independently of other states given the current and wave of globalization remains a topic of further debate for broader academic discourse. Nevertheless, a proper means is duly required, either in the form of diversification or regional economic strategy, towards a viable independent economic system for Nigeria.

Observation through these lenses of domestic and international issues shows that economic diversification is essential, which is not a new phenomenon in the Nigerian context but has not been given consistent attention to become a sustainable policy. Many scholars have advocated for its importance in the wake of international development, stressing the need to cusp between an oil economy and a more diversified economy, as several economies, both oil-rich and oil-dependent, are looking to renewable sources of energy due to the critical implications bedeviling crude oil and its impact on the environment, leading to climate change, which is practically negative to the survival of modern man in the 21st century. Hence, it is just and morally important to see and understand the critical reasons why there is a need for economic diversification and why the time is now if Nigeria is to survive among the committee of nations given the challenges in the global economy with the alarming presence of globalization, technological innovation, environmental hazards, and spiritual, moral, and intellectual paralysis.

First of all, it is important to recognize the presence of global advocacy for decarbonization, otherwise known as "Net Zero". Globally, nations have undertaken measures to reduce the emission of greenhouse gases to tackle climate change. For example, the European Union, which remains one of the leading buyers of Nigerian oil, has committed to reducing carbon emissions by 55 percent by 2030 [39]. Similarly, Canada has also succumbed to the decarbonization movement with a pledge to reduce emissions by 40 to 45 percent by 2030. The United Kingdom has equally pledged to reduce its carbon emissions by 78 percent by 2035, with an attempt to push it further to zero emissions by 2050. In addition, countries such as Ukraine and China, one of the world's largest consumers of oil and leading carbon emission is also heading towards an ecological civilization by 2060. Furthermore, a growing coalition of businesses, states, and institutions is also advocating for a decarbonization campaign. Put together, these players make up an estimated 76 percent of global carbon emissions. Furthermore, more than 1,200 firms have also set in motion a science oriented scheme to achieve net zero. A supporting number of financial institutions, over 1,000 cities, and more than 1,000 academic institutions have also joined the race for net-zero emissions with a pledge to undertake strong and immediate action to reduce global carbon emissions by 2030.

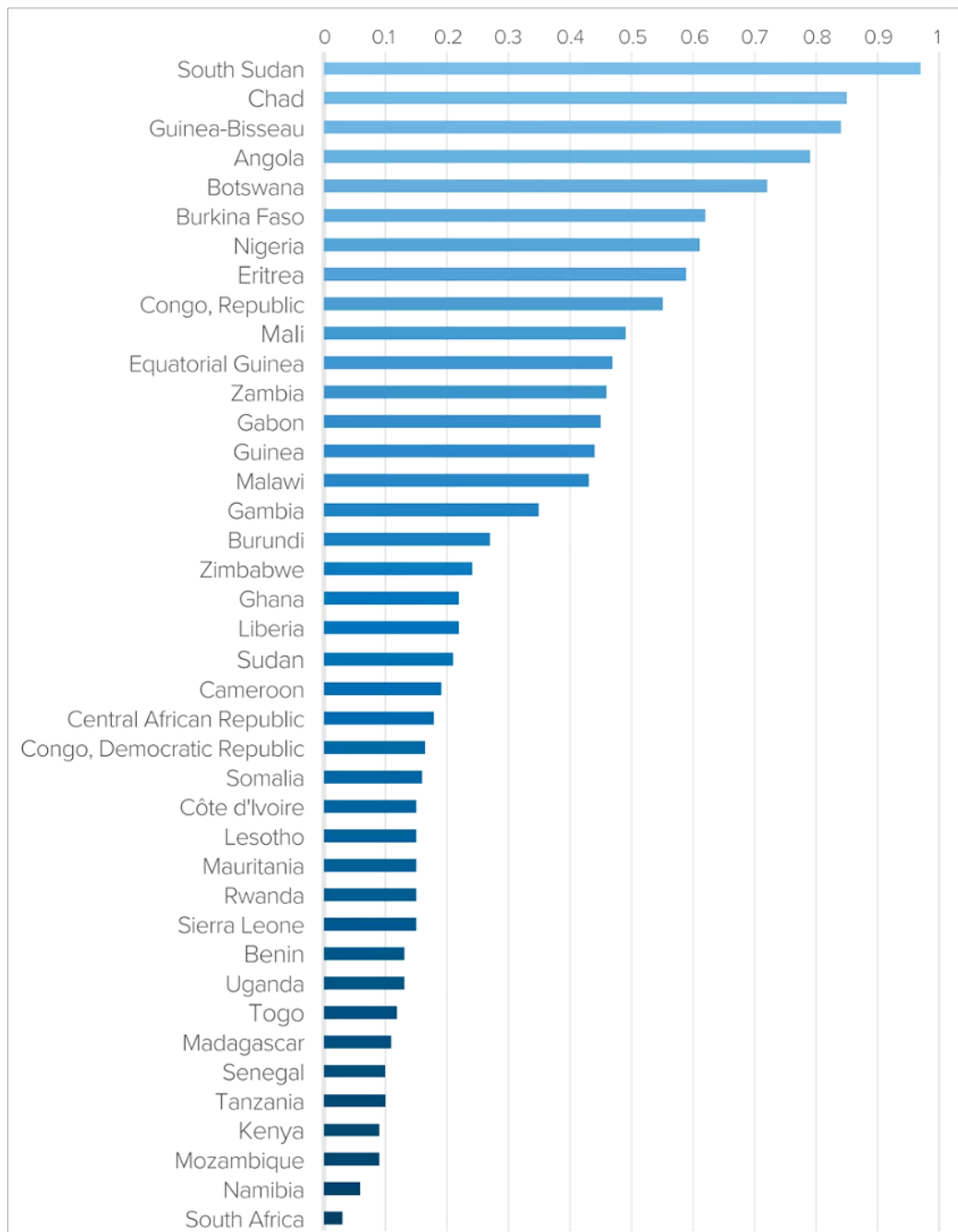
It is argued that excessive oil revenue has no substantial impact on the countries producing oil, which makes them more susceptible to socio-economic setbacks as well as other unidentified eventualities. although it varies among countries. For example, in Nigeria, approximately USD 15 billion is annually wasted due to the delay in the implementation of the Petroleum Industry Act 2021. More so, coupled with the decline in the international market for oil and gas, leading oil companies are reducing their investment but concentrating abundantly on low-carbon sources of energy as well as renewables. For illustration, in Nigeria, Shell has begun a complete divestment of its deep-sea and coastal portfolios, which other international oil companies are adopting a similar route. In the last decade, it has been estimated that Nigeria's crude oil reserve has been about 37 billion barrels. More recently, in 2017, the resources witnessed a decline from 37.5 billion barrels of oil to 36.9 billion barrels of oil in 2020 [14, 40]. The Nigeria National Petroleum Corporation (NNPC) reported that between 2001-2019, the downstream pipeline system had been vandalized about 45,347 times. As a result, the Nigerian Extractive Industry Transparency Initiative also reported that within a decade, Nigeria had witnessed a tremendous loss of about USD 41.94 billion due to the vandalization of pipeline infrastructure [23, 41]. Again, as a consequence, it has negatively affected the Nigerian economy, which necessitates the need for diversification of the state's economy from being overly reliant on oil revenue only [42]. In addition, the Nigerian economy is hugely susceptible to external and internal shocks in the price of oil, affecting all other sectors of the economy, especially as the oil and gas sector is experiencing multifaceted issues. The key stimulus through which Nigeria should channel most resources to economic diversification and prioritize alternative viable sectors such as agriculture, solid minerals, manufacturing, and services sectors should be further intensified [43].

It is also recommended that other alternative approaches be equally employed, which have to do with diversification from oil and gas to non-oil sectors [20, 44]. Irrespective of the fact that the Nigerian oil and gas sector generates a revenue of about 83%, which is significant. However, the fall in the price of oil has resuscitated the need to re-think how sustainable this source of revenue is to boost economic growth and foreign exchange earnings through the exportation of products to tackle this challenge. Hence, there is a dire need to diversify the Nigerian economy from being totally dependent on oil and gas to developing and revamping other sectors, especially cement, mining, fabrication plants, agriculture, automobiles, and information and communication technology (ICT), as other viable economic alternatives [45]. The centrality of human capital development for an improved economy is henceforth crucial and indeed required to establish a society that flourishes. However, according to the Organization for Economic Co-operation and Development (OECD) [46], the recent decade has shown that Nigeria is experiencing an enormous issue with regards to its human development, which includes a low level of primary education, an increase in child labor, and a low rate of



tertiary education among the 25-54 age bracket, which is also marked by a decline in the quality of staff training. In the past 20 years, Nigeria, in comparison to other developed countries, has ranked low in the global human capital index. For illustration, when paired with Norway and Finland, Nigeria's human capital index is rated at 48.86, while both Norway and Finland are rated at 86.64 and 85.86, respectively. This shortfall is widely attributed to the decline in technical skills required by employees in particular phases of the production line [16, 47].

Economic diversification is the process of shifting an economy away from a single income source toward multiple sources [48]. Diversifying the economy means sourcing different revenue from an expanding number of industries and markets. Diversification assists in managing the nature of skill volatility and human capital engagement to achieve a stable path toward equitable growth. It has historically, been used as a tactic to promote beneficial economic growth and development [49]. Evidently, Chile is an example of a varied economy with more than 2,800 unique products exported to more than 120 nations. Zambia, a country with equal copper resources, exports just over 700 goods, or one-fourth of Chile's total exports, to 80 nations. Empirically, in relation to Figure 2, the sub-Saharan African countries have not been competitively viable in taping resources to stand equal with some progressive developing nations outside the African continent that boost their economies via the trends in diversification policies when taking cognizance of Chile's economic diversification.



**Figure 2.** Export diversification in Sub-Saharan Africa, 2017- Adapted from OECD WTO, 2017

The report of a statistical finding in Figure 2, published by the Organisation for Economic Co-operation and Development (OECD) [50] in a World Bank Group contribution, explained the same concern for the need to embrace diversification of the economy in the Sub-Saharan African countries, where the majority of them depend on natural resources in metals, oil, gas, and other mineral resources, and most of the agricultural projects focus on subsistence farming instead of pure mechanized farming projects. Regarding African countries statistical ranking of diversification, Figure 2 shows that South Sudan has the most diversified economy, being the first on the ranking, followed by the Chad Republic; however, Nigeria is placed 7<sup>th</sup>, while South Africa is ranked the lowest among countries practicing economic diversification approach.

As per the position of Nigeria, it could be deduced that the slow action of the Nigerian policymakers in revamping the economic downturn, which requires aggressive diversification shortly after the impact of COVID-19 on the oil supply and demand, is responsible for the economic depression the country experienced shortly afterwards. Other previous factors militating against economic development in Nigeria are also responsible for its low ranking amongst African diversified economies. As a regional leader with wide integration, Nigeria should champion a sustainable, widely diversified economic course that supports technological and scientific facilities and huge capital-based economic power to lay precedence for the survival of other African nations. A study shows that very little economic diversification may have been put into practice in other low-income nations. For instance, Figure 2 shows both Malawi and the Lao People's Democratic Republic exporting about 310 and 550 items, respectively. Bigger oil exporting nations like Nigeria export disproportionately (780 items) and Kazakhstan exports (540 products), and they have not been able to significantly increase the variety of goods they manufacture and offer for sale [51].

## 5- Justification: Some Statistical Evidences

Figure 2 is a prism through which this study analyzed and justified the weakness in the diversification of the Nigerian economy when it found that countries like Malawi, with a population of just 20.4 million [52], export 310 items, and Laos, with a population of only 7.425 million [53], exports 550 items. What then stops Nigeria, despite its enormous estimated population of over 250 million with a huge unemployed workforce, from exporting more than 20 times the number of items in size as what Laos or Malawi are exporting. That development could be a justification for Nigeria to set precedence as Africa's largest economy and to prevent itself from experiencing a global economic shock if oil prices incidentally experience negative digits in the long run. Therefore, in reference to Figure 2, Nigeria is not doing enough to diversify its economy to prevent depression in the future.

The reasons for the need for diversification of Nigeria's economy away from reliance on fossil fuels are many, but the most important are that, the oil business in Nigeria is facing serious challenges ranging from local militant disruption of upstream and downstream activities, stealing of crude oil, and poor accountability. The Voice of America [54] reported that Nigerian security personnel allegedly found and torched an 87-meter-long ship in southern Delta State carrying 650,000 liters of stolen crude oil with seven crew members on board. In a related finding, the BBC [55] reports that the processed fuel valued at US\$250 million and worth 0.5 billion liters was stolen through the illegal drilling of 250 km of oil pipelines running north-east from Lagos in 2016 alone, according to the NNPC. The issue of inadequate supply of fuel at the domestic level alone creates an unauthorized increase in prices, a long queue at the fuel station, and serious hardship for the innocent people of the country. Dale [56], chief economist, found that currently, the worldwide car fleet consumes 19 million barrels of oil per day (Mb/d), or about one fifth of the world's total daily oil consumption of 95 Mb/d. Following this fact, oil producing countries should feel the concern on the best alternative as source for economic empowerment. The calculable perception is the oil supply may slump further when a majority of the world automobile is converted to electronic vehicles (EVs). Besides, more countries are still into active financing of oil exploration and with possibility to extract and put it on commercial sales which may cause further glut in world's production. All these and many other challenges affect oil revenue, which indirectly leads to a budget deficit in Nigeria's public financial records, which is a resultant impediment to the ability of the government to completely implement the designed policies and plans that support the sustainable wellbeing of the people they govern.

The objective is to show that the result of different strategies is also affected when rates of product innovation increase and emulation is facilitated. These comparisons suggest that the differences among the strategies in terms of promoting diversification are more pronounced when more product innovation and emulation are facilitated. With more than 2,800 unique products exported to more than 120 nations, Chile is an example of a varied economy. Zambia, a country with equal copper resources, exports just over 700 goods, or one-fourth of Chile's total exports, and only to 80 nations. In relation to the study under context, the latter are the sample of action-policies expected of Nigeria so that its dependence and reliance on oil production. It is therefore imperative that Nigeria rejuvenate its resources at the domestic level to lead the scheme of economic diversification in Africa. The country should quickly jettison its confidence, perception, and persistent publicity as one of the leading oil producers in Africa or as one of the world's first 20 large oil producing nations, as that does not translate to the strong economic power Nigeria needs to sustain itself independently. To ameliorate these challenges of unemployment, the sudden breakout of any pandemic disease, the unreliable global prices



of oil, and the concurrent servicing of the external loan that suckers away the entire country's generating revenue, there is a strong concern calling for the diversification of the Nigerian economy.

## 6- The Impact of COVID-19 on Small and Medium Size Enterprises in Nigeria

Small and medium-sized enterprises (SMEs) are the most affected by the outbreak of COVID-19 in Nigeria. This is because the majority of Nigerians depend on their privately financed businesses to survive, and it was greatly affected by the pronounced lockdown policy following the spread of the COVID-19 pandemic. As a result, the overall number of entrepreneurs was forced to shrink as all businesses struggled to adjust to the new challenges. Since these businesses are critical to the economy, the COVID-19 pandemic led to the loss of jobs for many employees too. To gain a broader perspective on the issue at hand, scholars have demonstrated the importance of SMEs in every sector of the economy.

Capturing the role of small and medium-sized enterprises (SMEs), Quartey & Afful-Mensah [57] argued that through entrepreneurship, SMEs also have an impact on the global economy as they help to create employment and increase government revenues. Ogonor [58] also argues for the need for international exposure and relevance for Nigerian SMEs and explains their commitment to goods and services that are of comparative advantage to other nations. This aspect could move Nigerian SMEs to the front seat of global competitiveness, all things being equal. Effiom and Edet [59] explain that small and medium enterprises in Nigeria are believed to account for about 40 percent of GDP and 70 percent of industrial employment [60, 61]. Small-scale enterprises were a total of 71,000 businesses, constituting 0.17 percent of the total, while medium-scale enterprises constituted 0.2 percent of the total with 73,081 enterprises [62]. The inaccessibility of many SMEs to financing in Nigeria is not the ultimate cause of their low performance; however easier it is to access finance, there may still be challenges in the choice of proper investment and diversification of marketable products, services, and supplies with the right skills that could manage the ventures effectively [63]. It is expected that the government should partner with private institutions that are basically concerned with innovation schemes for entrepreneurs to train Nigerian SMEs to become innovative while also equipping them with knowledge of financial scrutiny and proper accountability of the business. Hence, the impact of creativity and effective training on innovation while the Nigerian government provides robust limited-time interest-free financing and an enabling environment would help Nigerian SMEs maintain independence and sustainability.

The SMEs also have a unique way of adapting to rapidly changing economies under different political atmospheres at different times, which makes them viable as useful tools for economic recovery. Furthermore, the establishment of SMEs and entrepreneurship remain a driving force for the socio-development process of industrialization and economic growth. In addition, it also plays a crucial role in the development of local communities, particularly those outside the formal sector of the economy, such as artisans, among others [64]. SME's create employment opportunities, enhance regional/sectoral economic balance through industrial dispersal, and promote resource utilization [65]. In Nigeria, large companies with more than 300 employees are relatively few, and besides, at one point or another, they were small businesses until they grew over time through innovation to become sustainable. With the advent of the COVID-19 pandemic, businesses of all sizes were affected.

It is suggested that a policy that develops a larger percentage of individuals of strong character, spiritual fortitude, resilience, competitiveness, and creative perception in the education and industrial sectors be formulated. This strategy will bring a positive change in the overall economy using SMEs as a factor; it is more advantageous than breeding a young population of illiterates and "useless classes," as postulated by Harari [66] in his work *21 Lessons for the 21<sup>st</sup> Century*. The outcome is a population of youth that is self-reliant and not searching for ready-made jobs, which are now challenged and displaced by machines or Artificial Intelligence (AI). Through SMEs, the state will attain the required financial capacity to build a nation of entrepreneurs that will grow, thrive, and adapt to changes irrespective of the socio-economic condition and technological status of the country.

Looking at the current socio-economic challenges in modern history, for the education sector vis-à-vis the economy to survive, strive, and grow at the growing pace of technology, the majority of managers in SMEs must get an entrepreneurially designed education and training system. The latter will facilitate and accommodate potential SME investors' efforts to remain steadfast and keep abreast of the swiftly shifting and dynamic labor markets due to the advancement of technology that displaces traditional business models. For example, during the industrial revolution, cotton mills required workers without education. However, in contrast, with the technological revolution today, there is a need for education [67] to make the diversification of the Nigerian economy a success.

## 7- Investment in Nigeria's Agricultural Sector as a Catalyst for Economic Diversification

Agriculture is still maintaining its strongest position as the most inexhaustible natural resource capable of resolving most of the challenges confronting humanity. Therefore, whatever man-made sudden epidemic attack on humankind occurs, such as the COVID-19 pandemic, agriculture is the most sustainable rescue. The COVID-19 pandemic has forcefully paved the way for nations to get prepared, study, and accept as a necessity the impact of a well-functioning agricultural sector as the key means that provide relief when the situation reaches epidemic stage for any society. In the

case of Nigeria, the overconcentration of most national resources on the exploration and processing of oil to generate means of economic empowerment for the nation needs reassessment by Nigerian policymakers in order to diversify part of the national financial and human resources for agricultural production. This strategy will support Nigeria's market global competitiveness and prevent intermittent economic viability, especially during any sudden pandemic breakout, as witnessed during the COVID-19 pandemic, when the Nigerian economy suffered depression since 1980 as a result of the COVID-19 pandemic and the declining price of oil [68]. It was a hard lesson for Nigeria as demand for its only external revenue earnings nearly came to a standstill when all nations short down economic activities to prevent human interaction in order to curtail the spread of the COVID-19 viral disease.

Those countries with larger economic diversification were able to use their resources to improve economic activities, such as the US, China, and Germany, which maintained their first three positions in the Global Economic Diversification Index 2023, while small countries like Singapore, Switzerland, and Ireland with wider economic diversification maintained positions in the world's first 10 countries with the highest EDI in 2023 [69]. A study shows that the widely diversified economies were able to withstand the shock presented by the COVID-19 pandemic. Therefore, Nigeria should not be seen as an exception to using the advantage to solve unemployment, poverty, balance of trade, inflation, food sustainability, and economic growth because the wider the diversification of the economy, the more sustainable the economic power becomes.

An economic diversification without agriculture is a tentative survival. If a nation cannot produce its own food, then it will remain a slave to those who do and supply her food; that was the experience witnessed during the COVID-19 pandemic with states that import most of their agricultural items. For instance, the United States (\$86.6B), Germany (\$44.3B), United Kingdom (\$34.2B), France (\$30.9B), and China (\$30.4B) were the major importers of food in 2021. Food exports increased by 13.4% between 2020 and 2021, rising from \$623 billion to \$707 billion [70]. The latter shows that countries that are not sustainable in food production exported a lot during the unprecedented COVID-19 pandemic, despite their wide economic diversification status.

Therefore, nations that import most staple part of their food stuffs found the situation very tough as a result of food supply shortages. Food is the essence of life, and where there is no food, there is no life, and where there is no life, there is no society. Therefore, the agricultural sector in Nigeria needs to be revamped to serve as a catalyst for national revenue and food safety, given the challenges and issues associated with oil production at both local and international markets, which are now being disrupted by the outbreak of the COVID-19 pandemic and other unforeseen future constraints.

From a historical viewpoint, before 1956, when Nigeria discovered commercial oil, agriculture was the major driver of its economy, contributing a huge amount of revenue estimated to be about 63% of GDP [71]. This resulted in an increase in revenue, employment, and foreign exchange earnings for the federal government. Furthermore, providing genuine support for domestic agricultural products that facilitate the practice of mechanized farming for products like cocoa in the western region, groundnut in the northern region, and rubber and palm oil in the east to initiate an increase in economic activities is an unavoidable responsibility of Nigeria following a lack of technological manufacturing industries to support growth. Therefore, developing the process of these crops into viable cash crops for export via the international market [15, 72] is feasible for Nigeria, where available arable land stands at 38.43% of total land and 70.8 million hectares of agriculture are available. Therefore, a pandemic such as COVID-19 could be a sudden attack that forced normal activities to a standstill, but agriculture remains a determinant for the successful existence of the developing nations, all things being equal. However, even if Nigeria embarks on a diversification strategy with agriculture as a major target, it is not entirely free from many constraints against a successful agribusiness. Below are some identified significant challenges.

## **8- Some Challenges Confronting Agriculture in Nigeria**

The advent of advanced modern technology such as GPS technology, crop sensors, farm machines, and biotechnology, coupled with the use of inorganic fertilizer, different agricultural machines, and active pesticides, has made the agricultural system a promising future that will achieve a strong economy as far as food remains the central need to sustain human existence globally. Hence, there is a need for a considerable amount of investment in this sector to procure those identified constraints. Furthermore, Nigeria's low output in agriculture is linked to poor land tenure systems, insufficient irrigation for agricultural activities, and climate change, to name a few. Additional factors include inadequate funding, significant post-harvest losses, low technology, high production costs, and poor input distribution [73, 74] added that Nigeria's cultivable agricultural land is below 50%, and this land is mostly cultivated by small and traditional farmers using underdeveloped skills and methods, resulting in low yields. Other challenges cut across lack of access to modern tools and credit facilities, lack of infrastructure such as good roads and rail to facilitate direct and timely access to markets, environmental and land degradation, as well as poor research and extension services. Furthermore, there is a lack of food processing and manufacturing tools that transform agricultural products during gluts into manufactured goods and prevent perishable crops after harvest. Lack of storage facilities to prevent price hikes during scarcity of some products are additional challenges. In consequence, food inflation increased to 22.95% in Q1,

2021 [75], shortly after the tension of COVID-19. Nigeria's total agricultural imports between 2016 and 2019 were N3.35 trillion, which is four times more than the country's total agricultural exports of N803 billion during the time frame [68].

## 9- Solution

Furthermore, the use of local inputs in materials and resources and the adoption of domestic tools will enhance and accelerate the process of food sufficiency with the participation of higher and middle-level human effort. However, the issues of poor infrastructure, corruption, a poorly developed agricultural system, and a lack of innovation and capital are hindering the potential of Nigeria's agricultural development. Although the rise and fall of any business endeavor depend mostly on the available human resources [76]. In fact, accountability is the overall necessity for the success of economic diversification policies; therefore, Nigerian policymakers should take this as a significant factor.

If these constraints are properly addressed, it could help create jobs, increase foreign earnings, and the potential to improve living standards [77]. Thus, sustainable agricultural development could be achieved if the large investment required to cater for the use of farm power and machinery is integrated with the management and conservation of soil in order to reduce the level of erosion is achieved [18, 78]. Agriculture aids the production of raw materials and fosters sustainable development when practiced with the right skills and techniques [79].

From a broader perspective, [80] argued that the agricultural sector is key to a wide level of economic growth, which can also contribute to the decrease in food insecurity and poverty, particularly in Sub-Saharan Africa, where 50 million small farmers' incomes are dependent on the agricultural sector. In addition, [17, 81] argued that the agriculture sector holds a significant and strategic role in increasing food availability and the potential to attain food security. Hence, the development of the agricultural sector is critical to diversity, improved nutrition, food security, economic transformation, and economic growth under a properly monitored economic diversification policy that must be prioritized in Nigeria in particular and the world at large.

## 10- Discussion

In this study, the impact of COVID-19 on the oil and gas sector in Nigeria is investigated. Insights from literature show that the COVID-19 pandemic had a significant negative impact on the oil and gas sector in Nigeria, which is the country's largest contributor to the economy. According to Abba Ahmed [2], the pandemic led to a decline in oil prices and reduced demand for oil due to a decrease in economic activities globally. Nicola et al. [5] also established in their study some findings that are convergent with those of other authors, and the findings are substantially correlated with the fact that COVID-19 was detrimental to the economic development of Nigeria. This has resulted in a decline in the government's revenue and foreign exchange earnings, which have further worsened the country's economic situation. Empirically, the figure 1.0, an [8, 25] graph, shows the trends in the price of oil during the COVID-19 phase. The previous prices of US\$70/barrel in 2018 and US\$65/barrel in 2019 when the COVID-19 started a sharp was identified in 2020 when the COVID-19 was fast spreading across the world and a situation called adherence to Standard Operation Procedure (SOP) occurred. During this time, economic activities were almost at a standstill.

Nigeria's economy is highly dependent on oil exports, which account for over 90% of the country's export revenue and over 50% of government revenue. The drop in oil prices due to the pandemic has led to a significant decline in the government's internal and external revenue and foreign exchange earnings. This has had a ripple effect on the economy, as the government has had to cut spending on critical infrastructure, health, and social programs [82]. The pandemic has also affected the operations of oil and gas companies in Nigeria, as they have had to reduce their workforce and cut costs to cope with the decline in oil prices. This has led to a decline in investment in the sector, which could affect the country's ability to sustain its oil production in the long term.

The impact of the pandemic has therefore highlighted the need for Nigeria to diversify its economy, according to Hassan et al. [83], in agriculture in order to reduce its dependence on oil exports and imports. The government has acknowledged this need and has embarked on initiatives to promote economic diversification, but many constraints are responsible for their ineffectiveness. One such initiative is the Economic Recovery and Growth Plan, which aims to diversify the economy by promoting investment in sectors such as agriculture, manufacturing, and the creative industry, as the GPD has been empirically adversely affected and well reduced by 6.1 and 3.7, respectively, within a year, according to Olujobi et al. [20]. However, the unabated insecurity and the fluctuation in currency value, uneasy access to procure agricultural investment loans, and poor infrastructure in the country, according to the majority of authors in the literature delimits the investors from embarking on aggressive investment partnerships as the federal government seeks an alternative source of revenue, as evidenced by the fact that food exports increased by 13.4% between 2020 and 2021, rising from \$623 billion to \$707 billion [19].

The theoretical contribution takes its relevance from institutional theory and is in line with the study's focus, as the institution is the only formal authority in society that could finance or is in possession of the required capital base to

restructure the economy through diversification policy to meet economic revitalization [29]. The institution in international relations is the only agent that could represent a nation to negotiate for integration; hence, it is incumbent on it to adjust changes that can cushion the effect of any sudden change the environment or natural disaster may suddenly exert on the economy within a particular period of time so that the national economic procedure and activities are protected and kept sustainable [69]. Furthermore, increased investment could tackle those aforementioned challenges confronting the government and the farmer in implementing diversification of the economy successfully.

Investing in human capital development, SMEs, and the agricultural sector is critical to promoting economic diversification in Nigeria. Human capital development can help to promote innovation, productivity, and entrepreneurship, which are essential for the growth of SMEs and the agricultural sector. SMEs and the agricultural sector are crucial for the overall development of a diversified economy, as they can provide employment opportunities and boost local production, which can reduce Nigeria's dependence on imports.

### ***10-1-Analysis of the Study***

The study identified gaps in the literature, and the gaps are that despite the fact that most of the authors focused on the COVID-19 pandemic as a hindrance that caused a complete halt to economic activities within the late period of 2019 to 2021 and resulted in a decrease in the price of oil and gas. The study found that they did not suggest agriculture as an alternative; instead, most of them were on the handout of bailouts and revamping economic activities through fiscal policy. The SMEs are another alternative to streamlining the economy after such a sudden breakdown of COVID-19 that caused a slowdown in economic activities. For instance, SMEs are estimated to contribute 40% of the US economy, and a critical assessment shows that the protection provided for these SMEs has made it possible in a country where the interest on loans is valued at 8% compared to Nigeria, which maintains 18% as interest payable on loans with no exception to SMEs, agriculturists, or agribusiness entrepreneurs. All these are strong constraints on the economic development of Nigeria. Scott [31] found that regulative, normative, and cognitive are the three pillars of the institutional system that are central to the success of the strategies adopted by institutional entrepreneurs. Theoretically, the institutional theory has shown that the combination of organizations and institutions that make and regulate laws is the entity in charge of securing a viable business environment that could help SMEs. A creative, scientifically, and technologically driven entrepreneurship scheme with proper accountability will eventually contribute positively to economic growth in Nigeria if transparency is given a wider scope of freedom in governance. Also, Nigeria still lags far behind in economic diversification, even with its 7<sup>th</sup> position [84, 85] among the African states' economic diversification. Certainly, there is no gainsaying that Nigeria is at the forefront of any developmental scheme in Africa, except that the applied indicators and performance are close in rank with some well-economically developed nations outside Africa having equal or similar indices, such as Indonesia, Brazil, South Africa, and other countries where its level of economic status belongs. This can help promote economic growth and reduce Nigeria's dependence on oil exports, which can improve the country's resilience to external shocks.

## **11- Conclusion**

This paper examines the impact of COVID-19 on the Nigerian oil and gas sector. The COVID-19 remains one of the most shocking and devastating events in modern history, affecting almost all aspects of human activities, particularly health and the economy. In the Nigerian context, due to the impact of the COVID-19 pandemic, the supply and demand dynamics of the oil and gas markets were negatively affected by the fall in the price of oil. Consequently, the country runs a budget deficit on a yearly basis in its financial statements, which requires the readjustment of the budget in order to satisfy the fiscal challenge. The implications emerged, including the government's decision to borrow in order to counter the challenges. Another implication is that SME's loss of capital base, which has been used for personal use as a result of a long-term stay out of business with no alternative job, will suppress the pressure from Nigerians. So far, it is apparent that Nigeria's overreliance on oil revenue exacerbated this challenge, as the government had no major alternative source to respond to the new issue from a fiscal standpoint in particular. Hence, the need for diversification of economic resources to accelerate economic growth and increase national revenue.

Based on the latter, the study demonstrates the need for economic diversification, which is required beyond a mere necessity. Technically, for Nigeria to be able to increase its revenue to meet up with its fiscal spending, economic diversification is the way to go. External financial assistance, as the international organization such as OPEC, where it has played leadership roles for a long time, may not be able to rescue her in financial or economic empowerment to the best of her needs than to figure out financial independence through diversification of the economy. enable her to increase its revenue requirement for economic development that could protect its people and institutions. In doing so, the agricultural sector has proven to be a catalyst with great potential to provide a means to balance such a need. Given the historical precedents of agriculture's contribution to the Nigerian economy, it is not hard to come by such a fact. The Nigerian government therefore must do all that is necessary within its capacity to reform this sector to rescue the country from its economic crisis.



This can be best achieved only when the systems of economy and education are revitalized, integrated, and updated to meet the current economic reality, with a keen focus on the agricultural sector for sustainable growth and development. Only with this framework in mind and the policy of the government would such a task be actualized, considering some of the challenges facing the agricultural sector. Nevertheless, with the right comprehensive economic and education policy and the proper channeling of resources, a remarkable return can be achieved to address Nigeria's economic shortfall. A phenomenon that draws the attention of states with great agricultural potential, particularly in Africa. Putting these ideas into practice will stimulate the economy toward stability and steady development over time and help prepare for emergencies such as the COVID-19 pandemic.

### ***11-1-Limitation of the Study and Recommendation for Future Studies***

This study is a conceptual paper that addresses the impact of COVID-19 on the Nigerian oil and gas sector. It provides insight, drawing on analysis from previous studies, in order to establish a gap with the argument that the Nigerian government diversifies its economy with investment in agriculture and the development of SME's. However, it is not an empirical paper to show evidence that these ideas and frameworks actually produce a positive result.

The study therefore recommends that future studies embark on this to cover the gap in the literature and provide sufficient empirical evidence to support this claim. In addition, other studies can examine the issue from a financial point of view, relying on insights and how other economies have been able to deal with this issue comparatively.

## **12- Declarations**

### ***12-1-Data Availability Statement***

The data presented in this study are available on request from the corresponding author.

### ***12-2-Funding and Acknowledgment***

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### ***12-3-Institutional Review Board Statement***

Not applicable.

### ***12-4-Informed Consent Statement***

Not applicable.

### ***12-5-Conflicts of Interest***

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the author.

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