Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics

Master's Thesis

THE IMPACT OF AGRICULTURE ON NIGERIA'S GROSS DOMESTIC PRODUCT

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DIPLOMA THESIS ASSIGNMENT

Canaan Ugo-Unachukwu

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Thesis title

The impact of Agriculture on Nigeria's Gross Domestic Product

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Objectives of thesis

The main aim of this study is to determine the impact the agricultural sector has had on the GDP of Nigeria.

The goals of this research work are:
• To analyse the relationship between agriculture and Nigeria's GDP.
• To Identify the benefits of Agriculture to the inhabitants of Nigeria.
• To make policy recommendations on how agriculture can be used to contribute to growth and development including deescalating underdevelopment.

Methodology

In order to fulfil the stated goals/objectives, Descriptive analysis and regression analysis will be employed. Descriptive statistics will be done to provide a graphical representation of various important data that will aid in satisfying the goals of the study. For this study, Annual data will obtained from World bank's World development indicators for the time period of 1991 -2020. The variables include Nigeria's GDP (Constant 2015 US$), Agriculture, forestry, and fishing value added, Industry (including construction) value added (Constant 2015 US$), Services value added (Constant 2015 US$) and Exports of goods and services (Constant 2015 US$). Ordinary Least Squared method will be employed during the analysis to determine the impact of the mentioned variables on Nigeria's GDP with aim of establishing if Agriculture plays a vital role in the growth of Nigeria's GDP. The formulation of the model in stochastic form is as follows: $GDP_t = \beta_0 + \beta_1\_Agricult_t + \beta_2\_Industry_t + \beta_3\_Services_t + \beta_5\_Expor + e_t$.

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Declaration

I declare that I have worked on my master's thesis titled "The impact of Agriculture on Nigeria's Gross Domestic Product" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 31/03/2022   _____

Canaan Ugo-Unachukwu

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THE IMPACT OF AGRICULTURE ON NIGERIA'S GROSS DOMESTIC PRODUCT

Abstract

The purpose of this study was to determine the impact of Agriculture on the GDP of Nigeria and to achieve this, annual data was obtained for a period of 30 years, from 1991-2020. Agriculture in Nigeria is a fundamental and indispensable part of the Nigerian economy. This sector is responsible for the daily supply of food to the population and absorbs about 36% of the nation's total labour force and has a contribution of 24% to the GDP of Nigeria. In order to determine the impact of agriculture on Nigeria's GDP, annual data was obtained from World bank from 1991-2020 and OLS regression was employed during the analysis. The result indicate that a 1% increase in Agriculture value added will result to an increase in GDP by 0.29%; a 1% rise in value added by Industry leads to a 0.25% increase in GDP; a 1% increase in value added by services results in a 0.45% increase in GDP; and a 1% increase in the value by exports of goods and services leads to a 0.04% increase in GDP. The result shows that agriculture significantly impacts the nation's GDP so the study suggests that the government needs to initiate policies that will support the income of farmers, investments should be made in the research and development of the agricultural sector and farmers need to be provided with farm equipment and inputs that will aid in increasing agricultural production and also improving the quality of these products.

DOPAD ZEMĚDĚLSTVÍ NA HRUBÝ DOMÁCÍ PRODUKT NIGÉRIE

Abstrakt

Cílem této studie bylo zjistit dopad zemědělství na HDP Nigérie a za tímto účelem byly získány roční údaje za období 30 let, od roku 1991 do roku 2020. Zemědělství v Nigérii je základní a nepostradatelnou součástí nigerijské ekonomiky. Toto odvětví je zodpovědné za každodenní zásobování obyvatelstva potravinami a pohlcuje přibližně 36 % celkové pracovní síly v zemi a na HDP Nigérie se podílí 24 %. Za účelem zjištění vlivu zemědělství na HDP Nigérie byly od Světové banky získány roční údaje z let 1991-2020 a při analýze byla použita regrese OLS. Z výsledků vyplývá, že 1% nárůst přidané hodnoty v zemědělství povede ke zvýšení HDP o 0,29 %; 1% nárůst přidané hodnoty v průmyslu vede ke zvýšení HDP o 0,25 %; 1% nárůst přidané hodnoty ve službách vede ke zvýšení HDP o 0,45 %; a 1% nárůst hodnoty podle vývozu zboží a služeb vede ke zvýšení HDP o 0,04 %. Výsledek ukazuje, že zemědělství významně ovlivňuje HDP země, takže studie navrhuje, aby vláda iniciovala politiky, které podpoří příjmy zemědělců, aby se investovalo do výzkumu a vývoje zemědělského sektoru a aby se zemědělcům poskytlo zemědělské vybavení a vstupy, které pomohou zvýšit zemědělskou produkci a také zlepšit kvalitu těchto produktů.

Klíčová slova: Zemědělství, HDP, hospodářský růst, obyčejné nejmenší čtverce, Nigérie

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1. Introduction

In an economy, several sectors play a role in ensuring that the economy flourishes and that individuals are able to provide themselves with the basic necessities that are required to live a good life. The activities of these sectors contribute to the growth and development of a country. An important sector which should not be neglected is that of agriculture as it plays a relevant role in many economies especially developing ones. For this reason, it is very important to investigate the impact this sector has in the Nigerian economy in order to be able to provide recommendations on how Agriculture can be better utilized so as to lead to growth and development as well as deescalating underdevelopment.

Nigeria is home to about 200 million inhabitants and is the largest economy in Africa with its 2020 GDP estimated at $432.294 Billion (The World Bank, 2020). Despite being the largest economy in Africa, a vast number of the population are living in abject poverty, incapable of providing themselves with the basic necessities needed to have a healthy and happy life. Onyeiwu (2021) noted that Nigerian National Bureau of Statics asserted that in year 2020, 40% of Nigerians live in poverty and this figure is projected to rise to 45% or 90 million in 2020. According to The National Bureau of Statistics (2021), Inflation in Nigeria is Currently at 16.63%. A continuous rise in the price levels of goods and services in the country is a major factor contributing to the extreme increase of poverty rate in Nigeria. These inflationary pressures that confront the country has driven huge number of its inhabitants to extreme levels of poverty.

Figure 1 Regional breakdown of Undernourishment
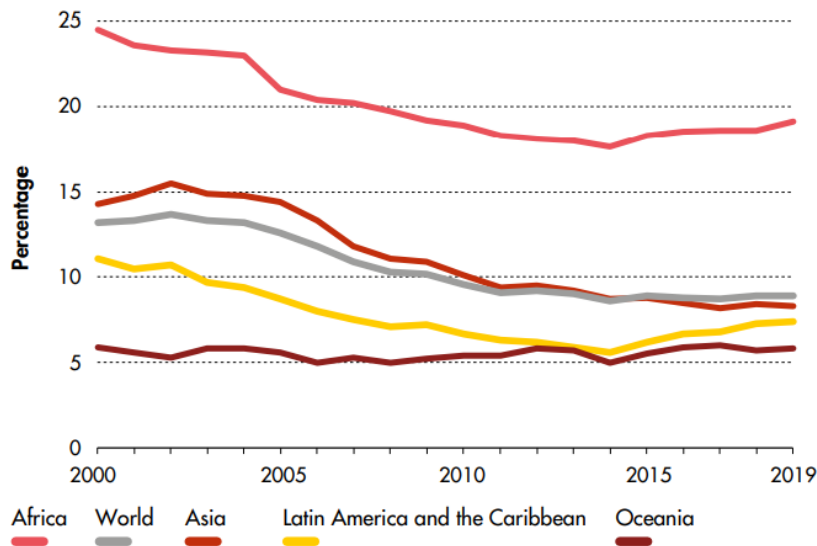
Source: FAO, 2020

Figure 1 above shows the prevalence of undernourishment by the various regions. As seen in the figure, there is seen to be an upward trend in prevalence of undernourishment (POU) since 2014, ten years prior to 2014, the levels can be seen to have been declining. In 2019, approximately 9% of the world's population suffered from undernourishment and Africa as seen in the chart accounts for a large proportion of this percentage. POU is highest in Africa and are upward trend is noticeable since 2014 (FAO, 2020).

Although Nigeria has been faced with economic problems over the years, the agrarian sector is one which can play a significant role in enhancing the welfare of the nation. An obvious but still very notable importance of Agriculture is that it ensures the continuous supply of food to any given country, and this applies to both developed and developing countries. Food security is being ensured when agrarian sector is properly utilized. USAID (2020) defines food security as having access to sufficient food needed to meet one's dietary and nutritional needs to be able to live a healthy and active life. Poverty leads to individuals being unable to access nutritious foods and this problem can be tackled through one's involvement in Agriculture. According to the Food and Agricultural Organization of the United Nations (2020), there has been several changes in the world in the past 6 years from the time it made the commitment to eradicate

global hunger, malnutrition, and food insecurity by 2030. Several factors which include extreme weathers, conflict and economic downturn have deterred the achievement of this goal which was formerly set. The food and Agricultural Organization of the United Nations data showed that in year 2020, a staggering figure of 720 to 811 million people were living in hunger. With the out-break of COVID-19, global hunger rose from 8.4% to 9.9% (FAO, 2021). A working and functional agriculture sector will ensure that the huge population of Nigeria are not left hungry and malnourished. There are several problems which could confront a nation, but hunger is one which may have a greatly negative impact on a country if not addressed. A population which in unable to provide themselves with healthy meals may resort to criminal acts such as robbery to be able to cater for this need. A vibrant agriculture sector could prevent this from happening.

Figure 2 Food Insecurity levels across regions
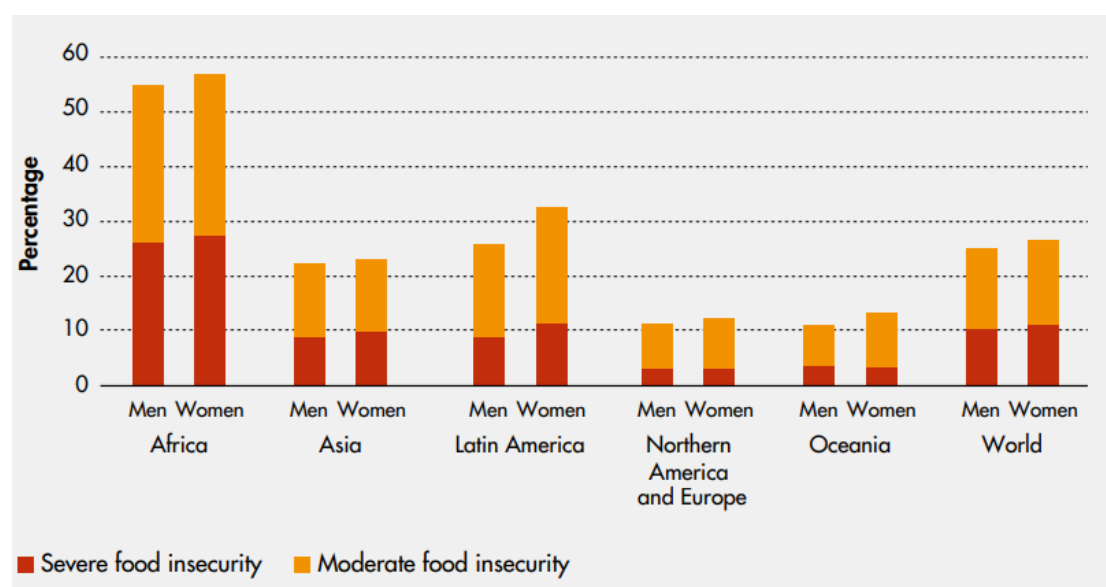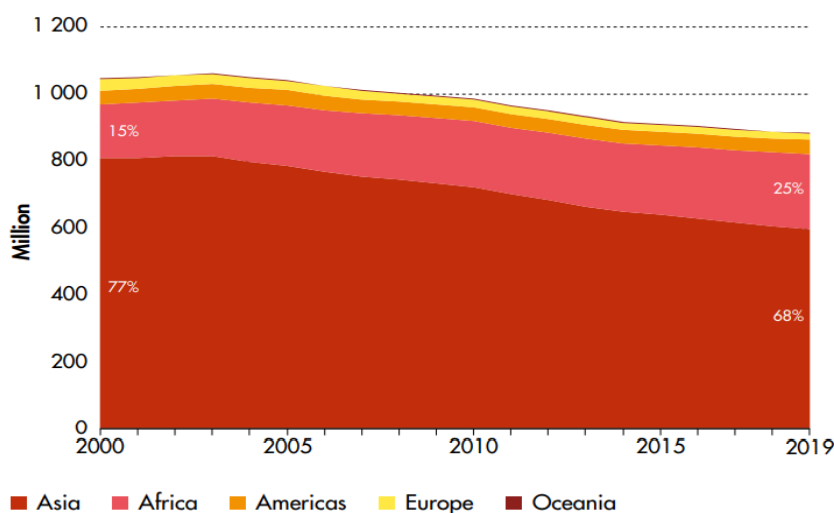

Source: FAO, 2020

Figure 2 above represents food insecurity levels by gender and region. Food insecurity is lowest in Northern America, Europe, and Oceania as the percentage ranges from around 10% t0 13%. As seen in Figure 2, food insecurity is slightly higher in women in comparison to men. The

graph indicates that food insecurity level is highest in Africa with both men and women being almost 60%.

Countries stands to benefit from their involvement in agricultural practices, the agricultural sector is a good source of revenue for the government. An increase in agricultural productivity will result in an increase in tax revenues from the agricultural sector. The revenue generated can be used by the government to finance developmental projects (Lee, 1971). The funds derived from agriculture can be directed towards road construction, stable electric supply, and public education. This advantage of agriculture is very essential especially in economies that are still in their developing stage such as Nigeria.

Figure below shows the share of unemployment by region namely, Asia, Africa, Americas, Europe and Oceania.

Figure 3 Share of employment in Agriculture by region

Source: FAO, 2020

As seen in figure 3 above, agriculture is an employer of labor in several countries around the globe. There can be seen to be a decline in employment in agriculture from 2000 to 2019. The agricultural sector as seen in figure 3 absorbs a substantial amount of the labor force in Africa and Asia with its share of employment being 68% and 25% respectively as at 2019. Africa is seen to be one the highest in comparison to other regions and a reason for this is the absence

of mechanization in the agricultural sector of Africa which still requires several agricultural operations to be done with human labor.

Figure 4 below represents the inflation rates for food by region from 2014-2020.

Figure 4 Inflation rates for foods by region
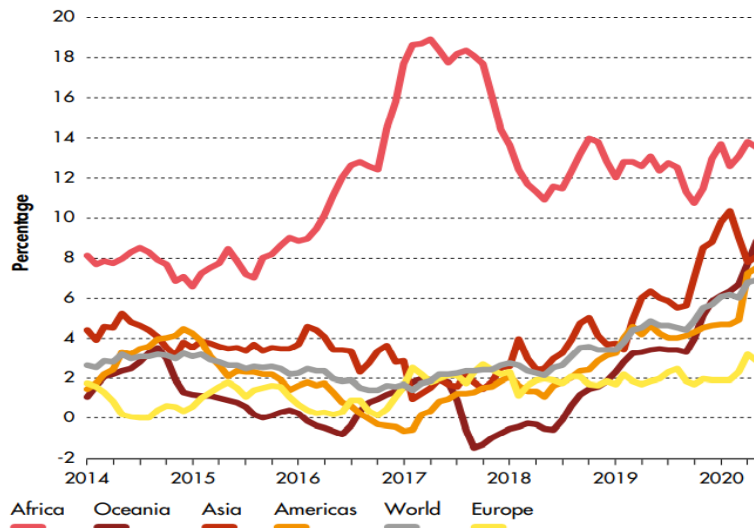
Figure 4 shows series of fluctuations in consumer prices. Amongst all the regions, Africa is seen to be affected the most as it peaks at 18.9% in 2014 and has remained high till present time. Inflation rate in Asia is the second highest as it was above 8% in 2020.

Productivity in agriculture is a viable means of combating the issue of hunger and extreme level of poverty as it can provide jobs for a huge proportion of the population thereby raising the incomes of farmers and households (OECD, 2021). In regard to global employment, agricultures accounts for 26.57% of world employment. In developing countries such as Nigeria, Zambia, Benin and Ghana, employment in Agriculture as a percentage of total employment in 2019 was 34.97%, 49.64%, 29.75%, 49.64% respectively (World Bank, 2021). The chart below shows employment in agriculture of the listed developing countries.

Figure 5 Employment in agriculture (% of total employment) (modeled ILO estimate) - Nigeria, Zambia, Benin, Ghana.

Year
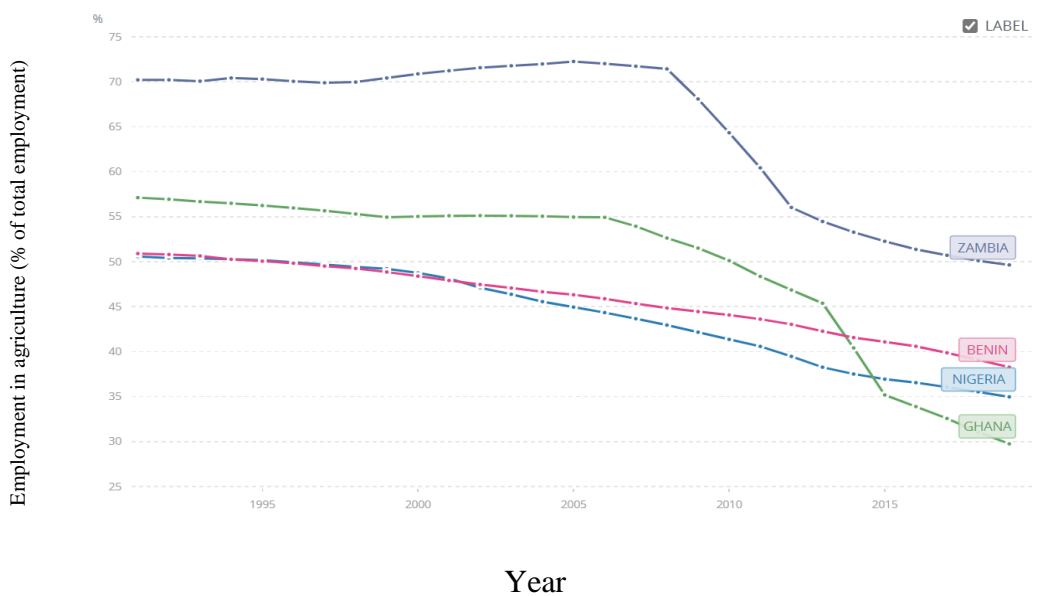
Source: World Bank (2021)

As seen in the chart above, there has been a steady decline in employment of this sector. Although there is seen to be a fall in the number of people employed in agriculture, it's role in ensuring that a huge proportion of the population are able to earn a living must not be taking for granted. Developing countries such as Nigeria are highly populated and other sectors such as manufacturing, and services are not as developed in comparison to countries such as United States and the United Kingdom. For this reason, it is important to ensure that individuals that are capable and willing to work are able to secure jobs to provide them with the essentials necessary for a good life and agriculture over the years has been able to provide the population of Nigeria with this opportunity.

Agriculture is seen to produce substantial benefits to countries that treat this sector as an important part of the economy. For this reason, the significance of agriculture in the economy of Nigeria will be accessed, the GDP of Nigeria will serve as an important indicator for this analysis using data from 1991 to 2020 and the application of time series analysis.

2. Objectives and Methodology

2.1. Objectives

The main aim of this study is to determine the impact the agricultural sector has had on the GDP of Nigeria.

The goals of this research work are:

- To determine the relationship between Agriculture and Nigeria's GDP.
- To Identify the benefits of Agriculture to the inhabitants of Nigeria.
- To make policy recommendations on how agriculture can be used to contribute to growth and development including deescalating underdevelopment.

In order to have a full understanding of the impact agriculture had in the economy of Nigeria in the last 30 years, it is crucial for the following research questions to be answered.

- How has the activities of the agrarian sector affected the GDP of Nigeria?

- What economic indicators can be identified to assess the overall performance of Nigeria from 1991-2020?

- With the results found through detailed analysis and application of various econometric methods, what recommendations can be provided to the government of Nigeria on how agriculture can be better utilized towards achieving economic prosperity?

2.2. Methodology

In order to fulfil the stated goals/objectives, Descriptive analysis and regression analysis will be employed. Descriptive statistics will be done to provide a graphical representation of various important data that will aid in satisfying the goals of the study. For this study, Annual data will be obtained from World bank's World development indicators for the time period of 1991 - 2020. The variables include Nigeria's GDP (Constant 2015 US$), Agriculture, forestry, and fishing value added, Industry (including construction) value added (Constant 2015 US$), Services value added (Constant 2015 US$) and Exports of goods and services (Constant 2015 US$). Ordinary Least Squared method will be employed during the analysis to determine the impact of the mentioned variables on Nigeria's GDP with aim of establishing if Agriculture plays a vital role in the growth of Nigeria's GDP. The formulation of the model in stochastic form is as follows:

$$GDPt = \beta_0 + \beta_1\_Agriculturt + \beta_2\_Industryt + \beta_3\_Industryt + \beta_4\_Exportst \quad (1)$$
$$+ E_t$$

The first step in the Regression analysis will be to carry out a stationary test. Stationary test will be done to ascertain whether the chosen variables have a unit root or not. A stationary test needs to be done in order to avoid a spurious regression which is when statistical summaries shows that there is a relationship between two variables when in reality, there is absence of a theoretical relationship between these variables. A number of tests could be done to determine if data is stationary but for this study, Dickey-Fuller test (ADF) will be employed. The general form of the ADF test is as follows:

$$\Delta Yt = \beta_1 + \beta_2 + \delta Y_{t-1} \sum_{i=1}^{m} a\Delta Y_{t-1} + E_t \quad (2)$$

Where ΔYt is the related variable, $\beta 1$, $\beta 2$, δ, α = Model parameters, t = Time trend, Et = Gaussians white nose with zero mean and possible auto correlation represented by time t. ADF defines a null and alternative hypothesis. The null hypothesis considers the series to be non-stationary indicating the presence of a unit root while the alternative hypothesis indicates the absence of a unit root. If the result of the test shows that the asymptotic p-value is not less than

Significant level α = 0.05, it indicates that data is not stationary. The log difference of the select variable will then have to be used for the test and this will lead to data being stationary. Secondly, a test for high multi-collinearity will be done. This to determine if there is strong relationship between the exogenous variables. If the result shows that multi-collinearity is present, this problem can be eliminated by modifying the variable in the form of first difference.

After the test for high multicollinearity has been done and the problem eliminated, OLS regression will then be carried out using the selected variables i.e.

$$GDPt = \beta_0 + \beta_1\_Agriculturt + \beta_2\_Industryt + \beta_3\_Industryt + \beta_4\_Exportst \quad (3)$$
$$+ E_t$$

Once this step has been completed, diagnostic tests will follow and they include Auto-correlation test, Normality test and Heteroscedasticity test.

3. Literature Review

3.1. **Agriculture**

Agriculture can be referred to as the several ways in which the world's population are provided with food and other products through either crop or animal consumption. Agriculture which is a familiar English word originates has a combination of two Latin words, *Ager and Colo* which mean Land tillage. Often times, the term agriculture refers to only crop cultivation and excludes animal husbandry although it comprises of these two practices (Harris and Fuller, 2014). According to the Oxford English Dictionary (1971), Agriculture is defined as the art and science of soil cultivation or refinement in conjunction with the planting of crops and rearing of livestock. Rimando (2004) views agriculture as activity undertaken by individuals that involves the raising of useful plants and livestock. Rubenstein (2003) noted that Agriculture is an intentional act or effort to alter the earth's surface through the rearing of animals or crop cultivation for the purpose of deriving economic gain or sustenance.

From a legal lens or perspective, Agriculture comprises of farming in all branches and among other things, It consists of the cultivation and tillage of soil, the production, cultivation, growing and harvesting of both horticultural and agricultural products, livestock raising, poultry farming and any other forms of practices carried out by a farmer on a farm along with such farming activities, but does not take into consideration the manufacturing or processing of sugar, abaca, tobacco, pineapple,, sugar or other farm commodities. (Art. 97 (d), Chapter I, Title II, Labor Code of the Philippines).

According to the Commonwealth of Massachusetts (2021), "Farming" or "agriculture" shall include farming in all of its branches and the cultivation and tillage of the soil, dairying, the production, cultivation, growing and harvesting of any agricultural, aquacultural, floricultural or horticultural commodities, the growing and harvesting of forest products upon forest land, the raising of livestock including horses, the keeping of horses as a commercial enterprise, the keeping and raising of poultry, swine, cattle and other domesticated animals used for food purposes, bees, fur-bearing animals, and any forestry or lumbering operations, performed by a farmer, who is hereby defined as one engaged in agriculture or farming as herein defined, or on a farm as an incident to or in conjunction with such farming operations, including

preparations for market, delivery to storage or to market or to carriers for transportation to market''.

For this particular study, Data regarding Value added in agriculture using constant prices will serve as an important indicator that will be applied during the analysis. As of 2020, Agriculture Valued Added (Constant 2015 US$) was estimated at $115.52 Billion (The World Bank, 2021).

Figure 6 Agriculture, Fishing and Forestry value added by region
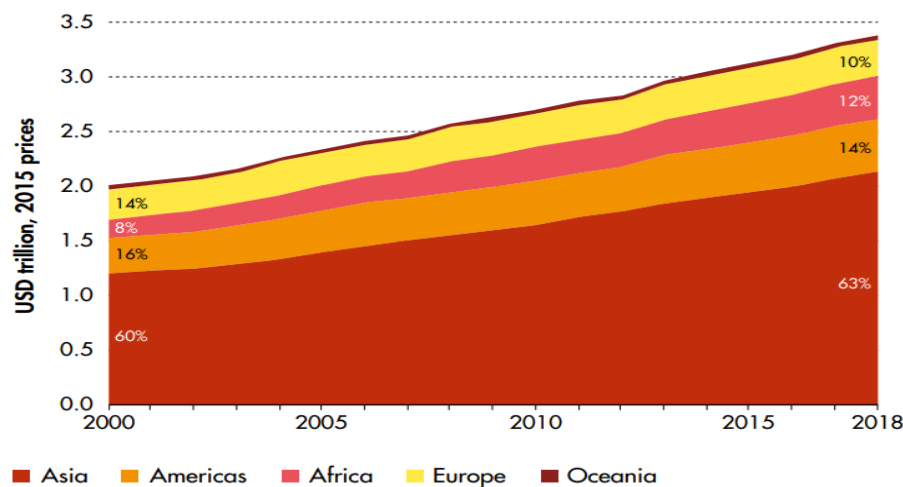
As seen in figure 6 above, there is s an upward trend in agriculture, fishing and forestry value added in the past few years. Over the periods, Asia is seen to be the highest contributor to value added as it accounts for 63% of the world's total in 2018 whereas the numbers for Americas, Africa, Europe and Oceania were 14%, 12%, 10% and 1% respectively.

According to The World Bank (2021), Agriculture culture corresponds to ISIC division 1-5 and its components are Hunting, Fishing, Forestry in addition to Livestock production and Crop cultivation. The term Value added refers to the net output of a given sector after all outputs have been summed up and immediate inputs subtracted from the total. When calculating value added, Deductions for depreciation of fabricated assets or depletion and degradation of natural resources are not taking into consideration. The international Standard Industrial Classification, review 3 or 4 determines the origin of value added (The World Bank, 2021).

3.2. Gross Domestic Product

GDP which in full stands for Gross Domestic Product is a term which is frequently used by several economists. In present time, it is used by global economies as a reference point when determining the health of their country. A growing GDP with an absence of inflation is a positive signal for an economy, whereas a declining GDP may indicate a economic downturn (Callen, 2020).

The figure for GDP is an indication of the value of the final goods and services a country produces within a given period (OECD, 2010). According the Bureau of Analysis (2021), The value of the final goods and services produced in the United states is being measured by the GDP. The overall health of a given economy is accessed by the changes in its GDP.

GDP measures a country's national income and output over given period of time (Kira, 2013). The Individual Countries calculate GDP in their own currencies. In order to promote comparability, the GDP estimates are converted into a common currency (OECD, 2010).

GDP consists of all goods and services produced and put up for sale in the market, some nonmarket productions also make up a country's GDP and examples include defence or education which is being provided by the government (Callen, 2020). Although, productive activity is being measured by GDP, some productivity activities are excluded from GDP. An example is black market activities as well as unpaid work (Callen, 2020). Dynan and Sheiner (2018) argue that in measuring GDP, most home production and other non-market activities for example Leisure are not taken into account regardless of the fact these activities will lead to an increase in true consumption of such households.

Callen (2020) mentioned that GDP does not take into consideration the depreciation of capital good such as Machinery and Buildings that are utilized in production. If this depreciation of these assets is considered by subtracting the value from GDP, the result will be net domestic product.

When measuring GDP, there are several methods or approaches to doing this. As mentioned by Landefeld et al (2008), The expenditure method or approach can be employed in measuring GDP. This method considers spending such as consumption, Government spending, Investments, and net exports. It is given by the formula below.

$$GDP = C + I + G + NX \qquad (4)$$

Where C = Consumption, I = Investment, G = Government spending and NX = Net export.

Another method that can be applied in calculating GDP is the Income approach. This method measures GDP by the summation of all income earned by the factors of production (Callen, 2020).

$$GDP = Total\ Income + Sales\ Taxes + Depreciation \qquad (5)$$
$$+ Net\ foreign\ national\ Income$$

GDP could also be calculated using the Production approach. Production approach measures GDP by summing up the market value added at each stage of production (Callen, 2020). Landefeld et al (2008) mentioned that this approach estimates the gross output of each industry and then subtracts other industries intermediate inputs and the result of this will be each industry's residual value added.

$$GDP = Gross\ value\ of\ output - Value\ of\ Intermediate\ consumption \qquad (6)$$

In addition to the various way GDP can be measured, it is particularly important to know that GDP can take two forms namely Real GDP and Nominal. Real GDP is a preferred form during analysis because it measures economic output while also taking into the effect inflation or deflation might have on this estimate, Using Real GDP as an indicator is more realistic approach in assessing the economic growth of a country in comparison to Nominal GDP (Bureau of Economic Analysis, 2021). As suggested by Caton (2018), the changes in the value of money can be accounted for when Real GDP is applied during analysis. Motley (1992) noted that if there is an increase or decrease in the average price levels over a period of time, this change in price will be reflected in nominal GDP and this does not aid in accurately measuring growth in real output.

 A decline in the value of money will result in higher nominal GDP whereas real GDP will not be significantly affected by this change. If the type of GDP used in a county's reports is not

specified, it is most likely to be nominal GDP. Real GDP is pure growth whereas nominal GDP includes both prices and growth (Caton, 2018).

For real GDP to be calculated, nominal GDP must first be estimated, which is the value of all goods and services in the market that are purchased by businesses, governments, households and foreign buyers (Feldstein, 2017).

To be able to accurately compare one time period with another, nominal GDP needs to be converted to Real GDP. This conversion involves dividing the increase in nominal quantities into a real component and an inflation component with the application of an appropriate price index (Feldstein, 2017). For this research, real GDP will be used as it will a more accurate picture of the growth that has taken place in Nigeria's economy.

3.3. The Role of Agriculture in an economy

An important theory that emphasises on the role of agriculture is the Fei-Ranis model of economic growth. This model is a dualism model in welfare economics and can be seen as an extension of the Lewis model. It is also referred to as the Surplus Labour model (Sadik-Zada, 2020). This model emphasises on the existence of a dual economy which comprises of both the modern and primitive sector and takes into account the underemployment of resources and unemployment. This is different from several growth models which are of the belief that underdeveloped countries and homogenous in nature (Economics4Development, 2016). The Fei-Ranis theory suggests that the primitive sector comprises of the existing agricultural sector in the economy, whereas the modern sector is the rapidly growing but small industrial sector (Thirlwall, 2006). This both sectors co-exist in an economy and this existence raises the issue of economic development.

The theory suggests that for development to take place, there must be a shift from a focus on agricultural output to industrial output. This occurs by the transference of labour from the agricultural sector to the industrial sector. Even after this shift occurs, the agricultural sector should not be neglected as it is needed to support the economy with raw materials and food (Fei and Ranis, 1961).

The work of Rostow (1960) specified five progressive stages of development which every economy must undergo in order for it to develop. These stages of development include Traditional, Preconditions to Take-off, Take-off, Drive to Maturity and High Mass Consumption. In the first stage, a subsistent agriculturally based economy is predominant. The labour force is heavily involved in agriculture and the population is unaware of the development of science and technology. In the second stage, the country begins to develop manufacturing as well as a more national/international outlook instead of a regional outlook. The third stage (Take off) is characterised short period of intensive and also the advent of industrialization. Institutions and workers begin to gravitate towards the new industry. In the fourth stage, a rise in the standard of living can be seen, there is increase in the adoption of technology and a there is economic growth and diversification. In the last stage (High mass consumption), The living standards of people become even much better, the economy flourishes, and mass production and consumerism is evident in such an economy (Rostow, 1960). Nigeria being a developing country can be said to be Take off stage, this is because there is a growing manufacturing sector as well as development of infrastructure in the nation (Benavides, 2021). For Nigeria to advance to the next stage, there needs to be more attention paid to critical areas such as health care and education.

3.4. Relationship between Agriculture and GDP

Agriculture is a crucial part of several economies as it provides food and job opportunities. These products of agriculture are not only consumed by producing country but are also sold to the foreign market. The exports of these agricultural products bring in revenue and this can aid in the development of an economy. Given the importance of this sector, it is important to look into the previously done works of authors on agriculture and GDP to determine the impact this sector has had in various economies.

Phiri et al (2020) conducted research to identify the role of agriculture in supporting the economy of Zambia and focused on the effect agriculture has on the country's economic growth. Data for the period of 1983-2017 was used in this investigation. ADRL Bounds test was utilized in this study. The ECM results indicate that agriculture, manufacturing, services, and mining converge to an equilibrium and have an effect on economic growth with the effect

from agriculture, mining, and services being significant. The result showed that the impact of agriculture was significant in both short run with coefficient unit effects of 0.482 and 0.342, respectively. Phiri et al (2020) noted that these effects are strong due to heavy reliance on farming by majority of the rural population and agriculture serving as an important medium for food security. It was suggested in this research that for the effect of agriculture to be much greater, farmers need to be supported with adequate infrastructure, better irrigation techniques and farming inputs and the government must institutionalize food processing industries that add more value to the country's income.

Potharla (2011) conducted a research work with aim of studying the co-integration between Gross domestic product and the Agricultural sector of India. The study covered for a period of 59 years from 1951-52 to 2009-10. To achieve the objective, Augmented Dickey Fuller test was employed to analyse the stochastic properties of the variables. Since, both of the mentioned variables are integrated to same order *I(1), Johansen's Trace and Maximum Eigen value test* were employed in the study to test the co-movement between the Agricultural Sector and GDP. The result of Johansen's co-integration test revealed that there is an existence of co-integration between Gross domestic product and the Agricultural sector. The indicates that there is a long-run equilibrium relationship between the GDP of India and its agricultural sector. Granger causality test was also employed in the research with 1 to 5 years of lags. With 2 years of lags and 3 years of lags, there was seen to be a causal relationship in both the directions between the agricultural sector and GDP at significance level of 10% (Potharla, 2011).

The work of Enu (2014) sought to determine the impact of the agricultural sector on the economic growth of Ghana and the effect of the various sub-sectors of the agricultural sectors on Ghana's economic growth. The period of 1996-2006 was covered in the study and data in regards to agriculture, industry, service as well as the various sub-sectors of agriculture such as forestry, fishery, crops/ livestock and cocoa were use in the study. Enu (2014) specified a regression model and employed Ordinary Least Squares in order to estimate the respective impact of agriculture, industry and service on GDP growth. The study revealed that agriculture had a significantly positive impact on GDP growth in comparison to other sectors (agricultural output (0.354515); service output (0.283401); industrial sector (0.303257)). Furthermore, the study analysed the impact of the various agricultural sub-sectors on GDP growth and the result showed that the cocoa-subsector is of vitally important to economic growth and development in Ghana and also suggested that with the discovery and growing dependency on oil, the cocoa-

subsector should be prioritised and not neglected essential for the country's economic prosperity (Enu, 2014).

A similar and more recent study was done by Nyamekye et al (2021) to analyse the contribution of the agricultural sector on the economic development of Ghana using time series data from 1984 to 2018. This study made use of co-integration tests as well as regression model. The co-integration tests indicated a non-existence of long-run relationships between overall GDP and Agricultural Output. The regression analysis showed that agricultural output has a significantly positive impact on Ghana's overall GDP (0.1951). The result agrees with the findings of Enu (2014) implying that the agricultural sector is of immense importance to the Ghanian economy.

Mero et al (2021) conducted a study with the purpose of analysing the empirical relationships between growth and agriculture's contribution to GDP, economic growth, as well as economic development of a nation expressed as national per capita income. The study analysed data for year 2018 and over 180 countries across the globe using statistical regression and descriptive methods. The study revealed that economic growth is positively affected by higher contribution of agriculture to GDP. There is positive relationship between the Economic growth and the growth of the agricultural sector, but its effect is inelastic.

Bein and Cifcioglu (2017) attempted to investigate the relationship between the relative GDP share of agriculture and the unemployment rate using a sample of ten central and eastern European countries. Annual data for the period of 1996-2013 was utilized in the study and the analysis was conducted using dynamic panel regression analysis and Granger causality tests. The findings indicated that unemployment is negatively related to the relative GDP share of agriculture. Furthermore, government expenditure and GDP growth were seen to have an insignificant impact on the rate of unemployment. The Granger test which was performed for the selected countries showed a causal effect of the relative GDP share of agriculture in some countries while in some other countries, causality was seen to be from the unemployment to the relative GDP share of agriculture. The study suggested that the existing high rates of unemployment could be addressed through agriculture but may not be feasible solution in every country (Bein and Cifcioglu, 2017).

The work of Moussa (2018) aimed to identify the extent to which the agricultural sector contributes to economic growth in Benin using annual data from 1970 to 2016 and co-integration method considering the order of integration. The findings revealed that GDP per

capita, human development index and agricultural value added have a long-run relationship and that the growth of the agricultural sector will significantly impact the economy of Benin in the long-run and Improve the living conditions of the populace. of Moussa (2018) proposed that with the absence of natural resources in countries such as Benin, investment in agricultural is crucial as it leads to the economic growth of Benin and is also a viable means of poverty reduction.

Mapfumo (2013) sought to determine how agricultural production has affected economic growth in Zimbabwe using time series data from 1980-2010 and employing linear regression analysis. The findings of the study suggested that the value of agricultural production of cotton, maize and tobacco has had a significantly positive impact in the economic growth of Zimbabwe from 1980-2010. A recent study by Runganga and Mhaka (2021) was carried out to determine the impact of the agricultural sector on economic growth in Zimbabwe, Autoregressive Distributed Lag (ARDL) technique was used in the study, employing time series data from 1970 to 2018. The study revealed that inflation, gross fixed capital formation and government expenditure positively impact economic growth. Furthermore, it also found that in the short run, agricultural production has a positive impact on economic growth whereas in the long run, there is seen to be no positive impact. Runganga and Mhaka (2021) emphasized that the agricultural sector has an important role to play in the early stages of economic development and as any economy develops, the role agriculture play becomes marginal. The study suggested that agriculture serves as an engine for economic growth in the short run but other macro economic policies should later be implemented in order to ensure economic growth in the long run.

A study by Masood et al (2015) aimed at analysing the role of the agricultural share in GDP in Pakistan's economy employing time series data from 1975 -2012. Ordinary least squared method was utilized in the study for the estimation of the model parameters. The variables considered in the study were agriculture, trade, industry, and GDP. The study found that a significant and positive relationship between the GDP and agriculture is Pakistan giving a coefficient unit of 0.399. Masood et al (2015) recommended that government of Pakistan must intensify its effort in improving the country's agriculture by laying out reliable policies that will aid in achieving economic growth.

Yao (2000) in order to ascertain the importance of agriculture in the economic growth of China, made use of empirical data as well as cointegration analysis. The findings of the study suggest

that despite the evident decline in agriculture's share in GDP, agriculture still plays a key role as a driving force for the growth of other sectors. Yao (2000) further added that the growth of non-agricultural did not have a significant effect on agricultural growth and this was a result of the Chinese government implementing policies which were biased against agriculture and restriction of rural-urban migration.

Tomsik et al. (2015) in an attempt to analyse the major changes in area of GDP structure formation (agricultural, services and industrial sector) which have occurred in selected Sub-Saharan African countries for a period of 20 years, decided to compare the GDP and GDP per capita in Sub-Saharan countries with the World GDP and GDP per capita. Comparative analysis was employed through logarithm regression and elastic analysis, and this was done to analyse the relationship that exists between GDP and GDP per capita in relation to the GDP value generated or produced by agriculture, industry, and services sectors. The findings of the study indicate that while several Sub-Saharan countries have attained the modern type of economy with prevailing services in GDO composition, agriculture still plays a dominant role in most countries with regards to employment. The study further notes that Sub-Saharan Africa is yet to reach the level of the global economic transformation (Tomsik et al, 2015).

Chandio et al (2016) carried out a study on the agricultural subsectors' performance. An analysis was done on sector-wise share in agriculture GDP in Pakistan using annual data from the period of 1998 to 2015 and Ordinary Least Square for the estimation of the parameters. For the study, the dependent variable was agriculture GDP and the independent variables included major crops, minor crops, livestock, and Forestry. The results showed that the sub-sectors of agriculture have a significantly positive impact in the agriculture GDP. Although the coefficient unit for Forestry sub-sector was positive, the variable was not significant. The study suggested poor result of the forestry sub-sector is due to lack of attention by the government to this particular sector. Chandio et al (2016) recommended that in order to improve the sub-sectors share in overall agriculture GDP, the government must invest in technologies that will aid in developing these sub-sectors.

Yetiz and Özden (2017) investigated the causal relationship between GDP, agricultural, Industrial, and service sectors using data for a period the period of 1968-2015 and employing data Engle-Granger causality/block exogeneity Wald test, Impulse Response and Variance Decomposition analysis. The result of the analysis indicated a unidirectional Granger causality

from agriculture to GDP and the other mentioned sectors, while these other sectors do not influence the agricultural sector.

3.5. Overview of the Nigerian Economy

3.5.1. The Nigerian Economy

The economy of Nigeria is the largest in Africa. Since the late 1960s, the petroleum industry has been the most economically important industry for the country (Udo et al, 2020). Nigeria is one of the largest oil producers in the world ranking amongst the top ten largest oil producers (Sawe, 2019). The Increase in world oil price from 1973 boosted economic growth in other industries namely transportation, manufacturing, and the construction industry. Due to the rapid growth of these industry, there was a large influx of individuals from rural areas into the urban centres and this movement negatively impacted agricultural production. Furthermore, this stagnation in agriculture led to Nigerians having to import basic commodities such as cassava and rice for household consumption (Udo et al, 2020). Due to the fluctuations in world oil prices, the agricultural sector has continued to be in crisis. Despite that a huge proportion of the population still engaged in farming, food production was at a small scale, forcing Nigerians to rely on costly food imports.

The government embarked on the privatisation of several state-owned ventures in the late 1990s. This privatisation was mainly in the power, transportation, and communication and this was done to improve the quality of the service offered as well as reduce reliance on the government (Udo et al, 2020). In the start of the 21st century, Nigeria was confronted with unsteady revenue flow. In response to this, the government engaged in international borrowing and also introduced several austerity measures. The 2005 debt-relief plan helped to lessen the debt burden faced by Nigeria. This debt-relief plan which was agreed by a group of countries known as the Paris Club, allowed for a majority of Nigeria's debt to be forgiven once it had paid back a certain amount. In 2006, Nigeria met this condition and became the first African country to pay up its debt to the group (Udo et al, 2020).

Figure 7 Exports of goods and services (constant 2015 US$)
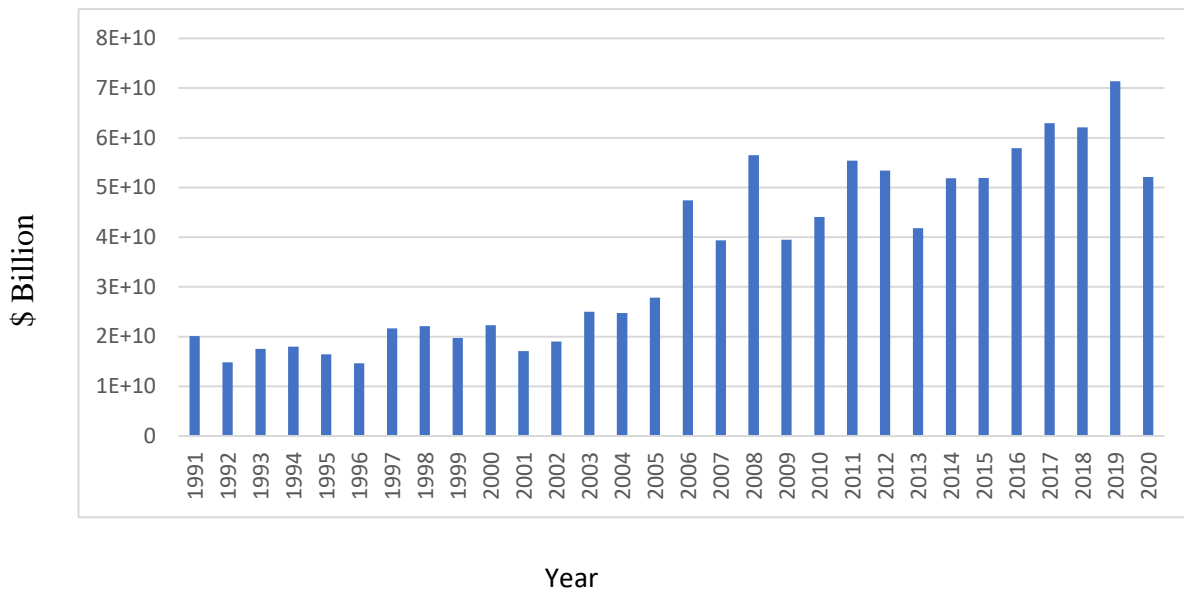
Source: World Bank national accounts data, and OECD National Accounts data files, 2021.

Figure 2 above shows the value of exports of goods and services in Nigeria from the period of 1991 to 2020. There is a fluctuating trend in the value of exports in the last 30 years with $14,626,927,660 being the lowest figure in 1996 and $71,382,138,449 (Appendix Table A) as the highest in 2019. These fluctuations can be attributed to the instability in Nigeria's exchange rate as the Naira (Domestic currency) has depreciated against the dollar.

Figure 8 Industry (including construction), value added (constant 2015 US$)

Year
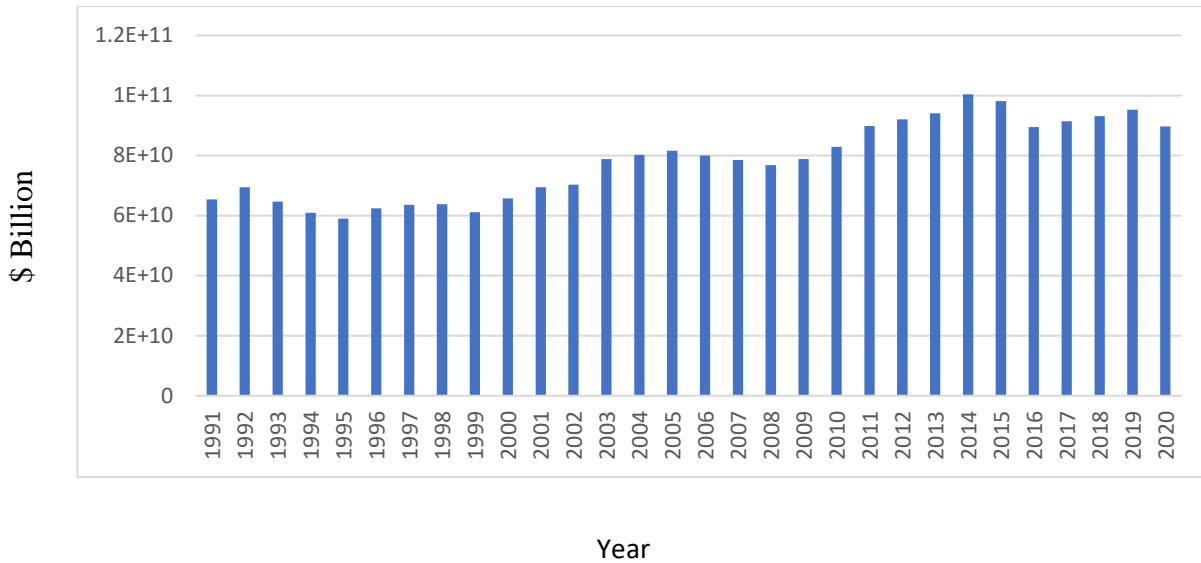
Source: World Bank national accounts data, and OECD National Accounts data files, 2021.

The chart above shows Industry (including construction) value added (constant 2015 US$) from 1991 to 2020 given an average of $78,232,110,700 for the prescribed period. The highest figure for value added in industry was recorded in 2014 as it was estimated at $100.3 Billion while its lowest was in 1995 given a figure of $59.042 Billion (Appendix Table A).
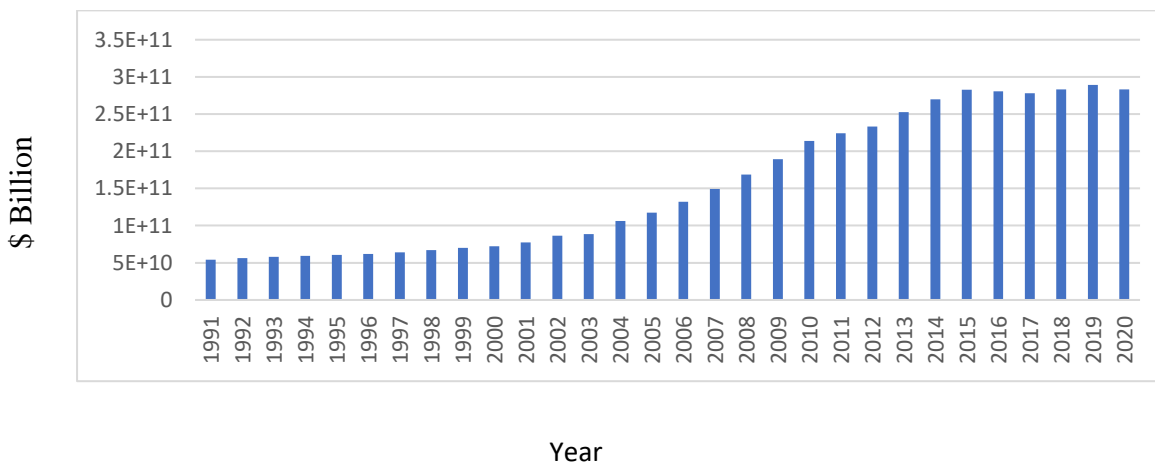
Figure 9 Services, value added (constant 2015 US$)

Year

Source: World Bank national accounts data, and OECD National Accounts data files, 2021.

As seen in figure 4 above, the value for services been steadily increasing for the 1991 to 2020. The service sector is of great importance to the economy of Nigeria has it accounts for 46.38%

of the nation's GDP (World Bank, 2021). The value for services in 2019 was the highest in the prescribed period with an estimate of $289.43Billion which is 433.472% increase from when compared to the 1991 figure which was $54.2454 Billion (Appendix Table A).

3.5.2. Recent Macroeconomic and financial developments

In 2020, Nigeria fell into a recession due to the decline in the prices of crude oil as result of a fall in demand for this product globally and the containment measures to address the spread of COVID-19. These measures set out by the government to stop the spread of the virus had a massive impact on trade, restaurants, hospitality, and aviation. The Central bank reported the overall Real GDP in 2020 dropped by 3%. However, this decline would have been worse but the mitigating measures in the Economic Sustainability Programme prevented this from being the case (African Development Bank Group, 2021). In 2019, Inflation rate was 11.4% during this period, it jumped to 12.8% and this increase was attributed to the rise in food prices due to constrained on domestic supplies as well as the changes in exchange rate premium which increased to about 24%. The inflationary pressures were further intensified by the government's withdrawal of fuel subsidies and also the increase in electricity tariffs. Fiscal deficit in 2020 widened to 5.2% from 4.3% in the previous year. Domestic debt in Nigeria accounted for 63% o f total debt whereas foreign debt represented 37% (African Development Bank Group, 2021).

3.5.3. Trade in Nigeria

In Nigeria, trade in staple foods exist amongst the different geo-political zones. The states in the southern region supply kola nuts, plantains, fruits and cassava to the northern region, which in turn supplies, livestock, onions and beans to the south. State in the central region trade Yams to the northern and southern states. A majority of these farm produce are traded in small neighbourhood shops, open market stalls and also on the streets (Udo et al, 2020).

Nigeria's major exports include crude oil, rubber and cocoa beans, with the main countries it exports to being the United States, India as well the several countries of the European Union

(Udo et al, 2020). The country's key import partners are the United States, the EU and China and its major imports include manufactured products such as textiles, iron and steel products, transport equipment, machinery, chemicals and food (Udo et al, 2020).

Figure 10 Nigeria's major export partners (2018)
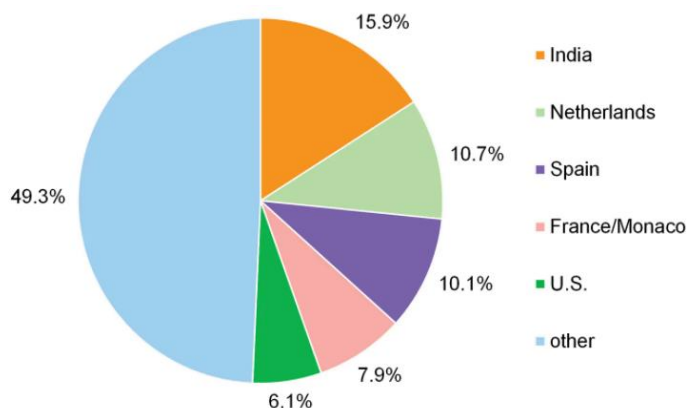
Source: Udo et al, 2020

As seen in the chart above, a majority of the Nigeria export go to India which accounts for 15.9% of its total exports. 10.9% to Netherlands, 10.1% to Spain, 7.9% to France/Monaco, 6.1% to the United states and the remaining 49.3% to other countries (Udo et al, 2020). These countries are essential to the Nigerian economy as exports aid in improving a country's GDP as well strengthening the domestic currency due to an increase demand for the country's products.

Figure 11 Nigeria's major import sources (2018)
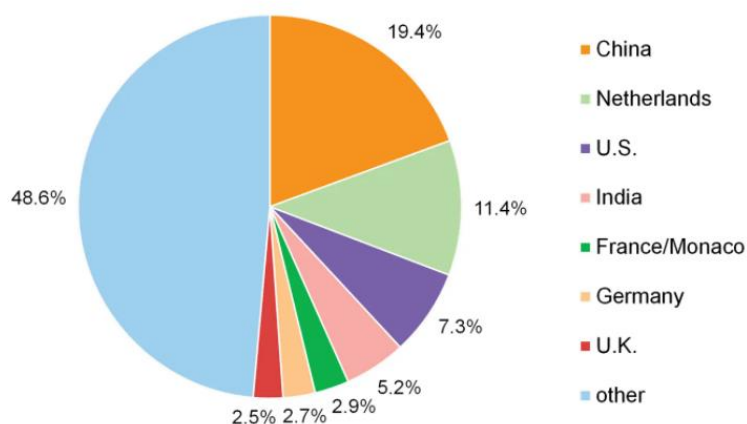
Source: Udo et al, 2020

The chart above shows the countries which Nigeria engages in trade with, to obtain products such as steel, machinery, textiles as well as food. A huge proportion of the country's imports comes from China which accounts for 19.4% of total imports, 11.4% from the Netherlands, 7.3% for the United States, 5.2% from India, 2.9% from France/Monaco, 2.7% from Germany, 2.5% from the United Kingdom and 48.6% from other countries.

3.5.4. Agriculture in Nigeria

Agriculture in Nigeria is divided into four sectors namely fishing, crop production, livestock, and forestry. Crop production is the largest of all the sectors as it accounts for about 87.6% of total agricultural output. Livestock accounts for 8.1%, whereas fishing and forestry account for 3.2% and 1.1% respectively. Agriculture is the largest sector in the country and is responsible for an average of 24% of nations GDP over the period of 2013-2019. Furthermore, the agricultural sector absorbs more than 36% of the labour force in the country making agriculture the biggest and of the most important employers of labour in Nigeria (Oyaniran, 2020). The figures below show the contribution of Agriculture to the GDP of Nigeria and the size of the different sectors in Agriculture.

Figure 12 Contribution of the Agricultural sector to Nigeria' s GDP
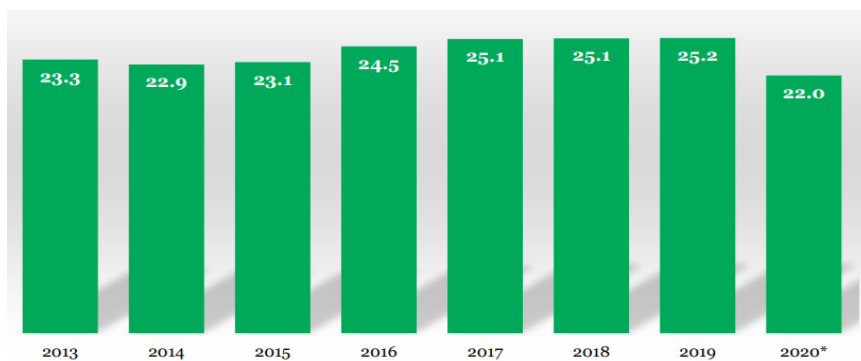
Source: Oyaniran, 2020   Year

Figure 11 above shows the contribution of the agriculture towards the GDP of Nigeria, as seen in the figure, there has been continuous involvement of agriculture in the nation's GDP for the given period. Agriculture plays an important role in the Nigerian economy as seen in the figure,

therefore, if more attention is given to this sector, there will be an evident growth in the Nigerian economy.

Figure 13 Size of the different sectors in Agriculture
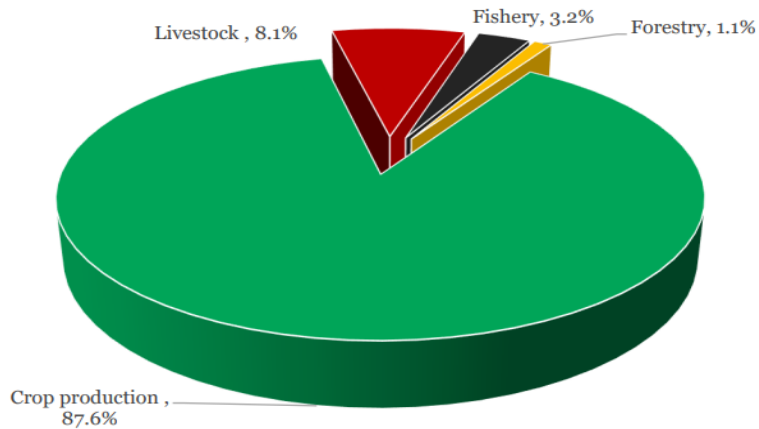
Source: Oyaniran, 2020

As seen in the chart below, from year 2016-2016, The total of agricultural imports was N3.35 trillion ($7.9 Billion) which is four times higher than the value of Agricultural exports 803 Billion Naira ($1.9 Billion) for the same period.

Figure 14 Top Importers and Exporters of Cereals as of 2018
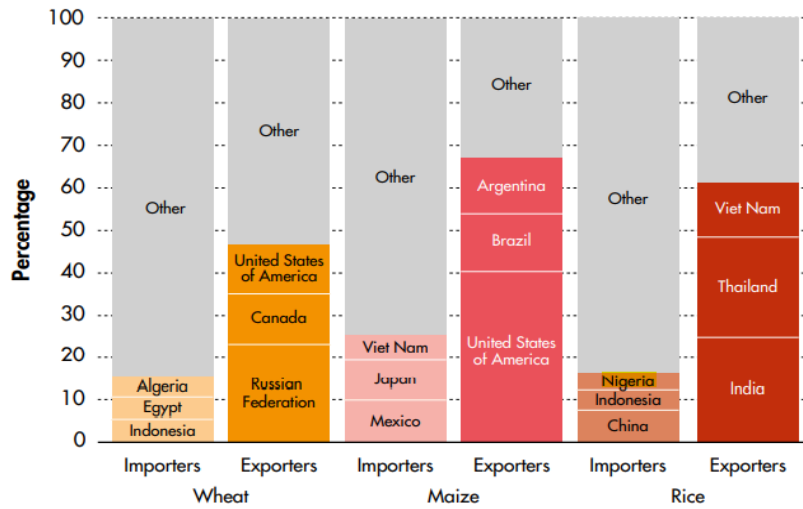
Source: FAO, 2020

As seen in figure 13 above, the top three exporters are responsible for a notable share of total exports which include 67% for maize, 61% for rice and 47% for wheat whereas the top three importers are responsible for 15 to 25% of all commodities (FAO, 2020). The chart shows that Nigeria is a major importer of rice. This figure is not surprising as in Nigeria, rice is an essential meal for several native dishes and is consumed by majority of the population.

Figure 15 Agricultural trade in Nigeria
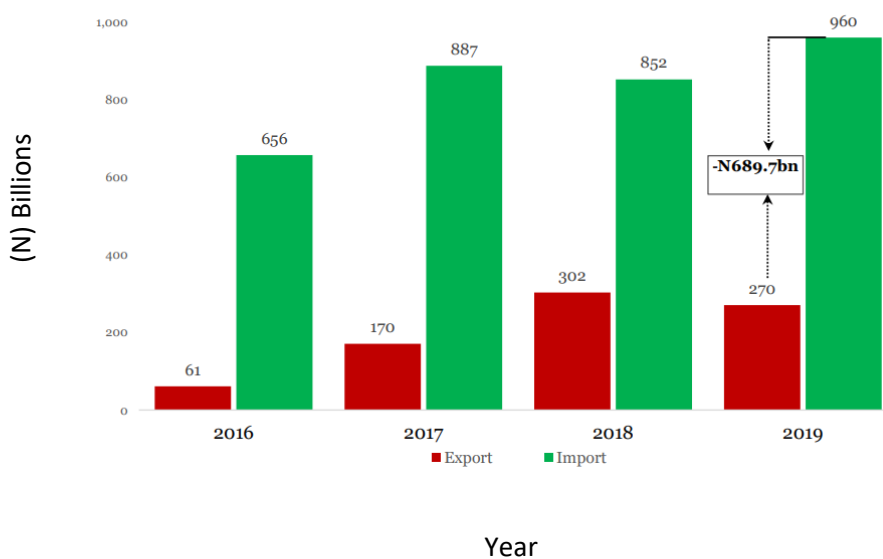
Source: Oyaniran, 2020

In comparison to crude oil exports, earning generated from the export of agricultural products is rather small. For example, in 2019, crude oil exports accounted for 76.5% of total exports whereas agriculture's contribution to exports was 2%. Nigeria engages heavily in importation of agricultural products as seen in the chart and its major imports include sugar, fish, milk, wheat and milk and its main agricultural exports are cashew nuts, sesame seeds, cocoa beans, ginger frozen shrimp and cotton (Oyaniran, 2020). Wheat is the most imported commodity while cocoa, cashews nuts and sesame account for over half of the nation's total agricultural exports. As seen if the figure above, agricultural exports in Nigeria fell from N302.2 billion ($725.6 Million) in 2018 to N269.8 billion ($647.8 Million) which indicates an 11% decrease. Simultaneously, there was a rise in imports by 12.7% from N851.6 billion to N959.5 billion. This figure is quite notable as it is the highest every recorded in Nigeria. Despite the agriculture being the biggest employer of labour in the country Nigeria remains a net food importer (Oyaniran, 2020).

In Nigeria, one-fifth to one-half of its inhabitants actively engage in agricultural production in order to earn a living. A good proportion of Nigerians are involved in small-scale subsistence farming producing only a little surplus for sale and earning income from the sale of cash crops and local crafts. Hoe and matchet are the dominant farm implement that these farmers use due to the soil not being amenable to mechanized equipment. Shortage of farmland in some localities and inaccessibility to land has hindered the size of farmland cultivated per family (Udo et al, 2020). Shortage in resources is one challenge that has confronted Nigeria's agricultural sector. Over the years, Nigeria has dealt with low yields per hectare due to inadequacy of farm inputs which include seedlings, fertilizers, harvesting systems as well inadequate irrigation. The shortages of these essential supplies have impacted productivity and yield rates in agriculture (Oyaniran, 2020). Lack of investment capital, an inefficient transport system, inferior storage facilities and environmental deterioration have led to stagnation in the agricultural sector of Nigeria. Despite the various efforts undertaken by the government to improve the state of agriculture in Nigeria, the rapid growth of the population and increase in urbanization had further led to food deficit in the country (Udo et al, 2020).

Figure 16 Maize production in Nigeria

Maize Production in Nigeria
Unit of Measurement (1000MT)
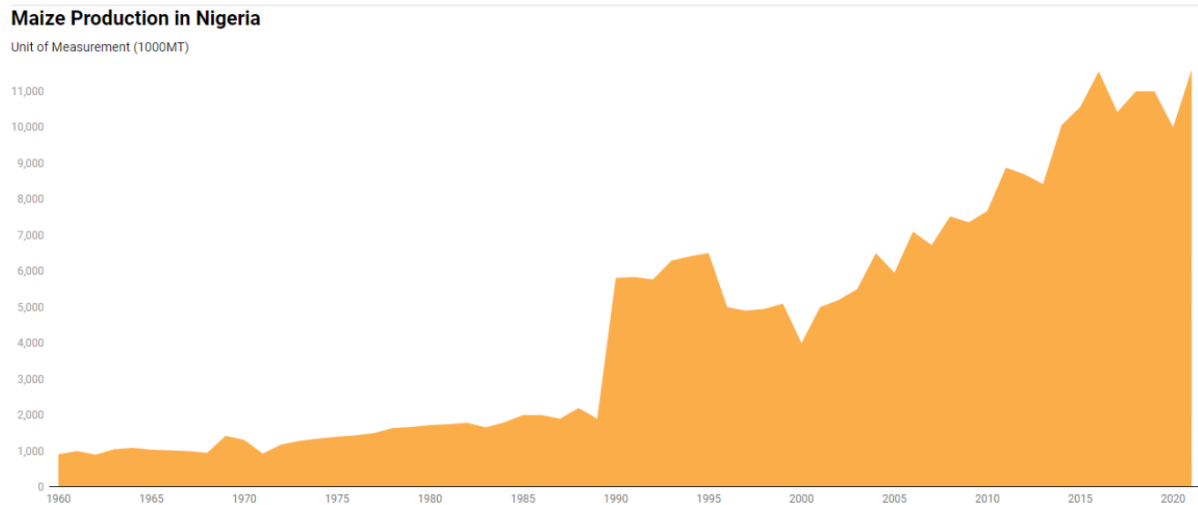
Source: Ekott, 2022

Figure 15 above shows the production of maize in Nigeria from 1960. Maize is a major export in Nigeria and is also consumed by most Nigerians as it is used in making several native dishes. As of 2021, maize production rose to 11.6 million metric tonnes. This is a 16% increase from 2020 when maize production was 10 million metric tonnes. There is a continuous rise in the production of maize and with a growing population of over 200 million inhabitants, production is likely to increase in the coming years.

3.5.5. Issues confronting agriculture in Nigeria

A major obstacle towards the growth of the agricultural sector in Nigeria is the existence of inadequate infrastructure. Infrastructure comprises of roads, railways, healthcare facilities as well as electricity, communication system and access to clean water. Production, trade, and Agricultural investment in the rural areas have been negatively impact by the terrible state of the infrastructural development in these areas (Olukunle, 2013). The dilapidating state of infrastructure in Nigeria has restricted access to markets causing agricultural products to not be able to be made available in areas thar are in need of them and this has also reduce the amount of income that could potentially be earned by farmers. Negligence from the government and poor leadership can be attribute to the current state of infrastructure on Nigeria (Olukunle, 2013). In regard to the conditions of the roads in Nigeria, Efforts have been made

by the Directorate of Foods, Roads and Rural Infrastructure, the National Agricultural land Development authority and the National Development Programmes, these efforts made have been sustained to bring about good road networks in the rural areas which is where a majority of agricultural production take place (Olukunle, 2013). Bad road networks have made movement of agricultural products amongst states more difficult and has also lead to a rise in the cost of transportation of these goods (Issa and Abah, 2021). In addition, after these roads have been constructed to allow for movement of goods and individuals from one place to another, due to poor maintenance and negligence, these roads begin to deteriorate after three to five years. In regard to education and health centres, rural areas are void of these amenities as they are mainly located in urban areas. Access to portable water is a major problem faced in the rural areas and unsteady power supply has slowed down the agricultural performance in Nigeria (Olukunle, 2013).

The use of outdated farm tools is also an issue that has affected agriculture in Nigeria. Farmers especially those in the rural areas still make use of the cutlass and hoes and have not been introduced to new and modern methods/techniques which will enhance agricultural productivity (Udemezue, 2019). Farmers not having accept to modern equipment will impact productivity as well as the quality of the products. Over the years, several machines have been developed to ease the farming and process and lead to better outcomes. These famers are not provided with these modern tools, and many are not even aware of their existence. There is a certain level of productivity which will never been reach if these rural are not provided with and made aware of this modern farming equipment (Udemezue, 2019). Poor technology, outdated farm inputs and inferior quality of raw materials are major setbacks of the agricultural sector. The government insufficient support, poor government policies, lack of awareness and lack of adequate research have all led to these problems. The government failing to provide adequate support has hindered the emergence of innovations from research institutes. A communication gap exists between farmers and researchers and coordination between farmers, extension agents and researchers are done poorly. These has an effect of productivity as these farmers are unable to take up new ideas and innovations that will ultimately lead to a rise in the productivity of this sectors (Olukunle, 2013).

The lack of storage and processing facility has played a role in the impeding the progress of agriculture in Nigeria. The absence of these facilities has impacted household food security as well national food security (Olukunle, 2013). Total food production may seem to be adequate,

but it will not lead to desirable effect on food security if these foods are not available to be consumed at the right the time and in the right form. Adequate storage and processing facilities are very essential because they will ensure that these foods which are produced can be made available wherever they are needed and whenever they are needed. Large amounts of farm produce perish after they have been harvested due to inadequacy in storage and processing facilities (Olukunle, 2013). Traditional storage facilities exist but are inadequate due to how they are structured, these traditional storage facilities are prone to attack by rodents and termites, are no moist-proof and pose difficulties when unloading and offloading. Majority of farmers consume a small amount of the their agricultural products, they produce them mainly to sell so as to earn income take care of their financial obligations (Olukunle, 2013).

Inaccessibility to media which include radio, television and social media has also negatively impacted agricultural productivity in Nigeria. Access to media could be of great benefit to farmers as it will better inform them timing, methods of planting as well as markets for their products. Information and Knowledge are essential elements for development to take place in any sector. For the development in agriculture, education in Nigeria is essential. Agricultural education is especially important as these farmers will be more aware of the field or are that they are working in. Being informed will have an all-round effect on both the farmers and agriculture in general (Udemezue, 2019).

Availability of human labour is requisite for agricultural activity to take place. In Nigeria, mechanization of the agricultural process has not been fully integrated, and this has made human labour an essential part of all agricultural operations. Despite agriculture being a labour-intensive sector, it still experiences labour shortages seasonally. These seasonal shortages are due to the migration of individuals from rural to urban areas in search of higher paying jobs and the effect of this movement is greatly seen in peak periods were labour is needed the for weeding and harvesting. Labour shortages has also driven up the price of labour which in turn affects the profitability of the farmers (Olukunle, 2013)

4. Practical part

This chapter contains the practical part of the study, OLS regression will be done in this section to analyse the Impact of agriculture on Nigeria's GDP.

4.1 Important indicators of economic performance

Economic indicators help in providing information in regards to the economic health of a particular country (Ashworth, 2015). Fisher (2020) suggested that economic indicators provide essential stats about an economy and enables the population to know where the economy is headed. Policy makers use economic indicators as useful tool in assessing the health of an economy (Mügge, 2016). When assessing the performance of an economy, the achievement of economic objectives shows the level to which a country has performed. These objectives could either be long term or short term. Sustainable growth and development are examples of long-term objectives, whereas a short term objective could be the stabilization of economy in response to an economic shock. The citizens of a country, use these indictors to the evaluate their politicians (Mügge, 2016). In order to know how well an economy has performed, employing a range of economic indicators can help to achieve this (Economicsonline, 2020). By utilizing these indicators for measuring performance, economists are able to ascertain whether a country's economic help has improved or whether there is a decline in the economy. These Indicators are very valuable to policy makers as they are able to know when to step in or intervene and also determine if an intervention yielded positive or negative outcomes. (Economicsonline, 2020). Some important economic indicators include Real GDP, Unemployment, Inflation, Terms of trade, Income and wages, and Interest rates. All the mentioned indicators are very important in determining the economic performance of country, in this study, the real GDP will be employed in this study as it has proven to be reliable tracker of the health of the economy and can be used to ascertain the standard of living of the population.

4.2. Sectors and their contribution to GDP

A 2016 World Bank and Organization of Economic Corporation and Development (OECD) report on agriculture prospects and challenges asserted that agriculture accounts for more than one-fifth of most Sub-Saharan African economies which includes Nigeria, Ghana, DR Congo, Kenya, Tanzania, Ethiopia, Chad and Malawi (OECD, 2016). In Nigeria, agriculture contributes to GDP and this GDP is also supported by other sectors which include Industry, Service and Exports as seen in the figure below.

Figure 17 Sectoral contribution to GDP from 1991 to 2020
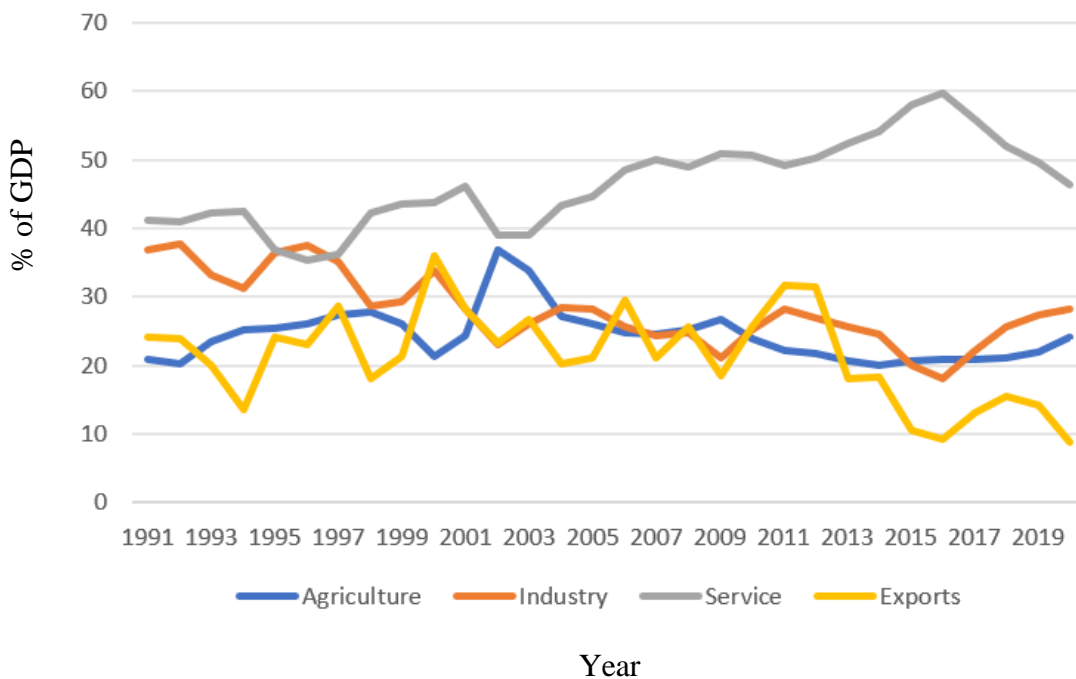
Source: World Bank (2021)

As seen above in Figure 16, Services contributed the highest to GDP with its contribution averaging around 46% over the stated period. Agriculture has contributed as well to Nigeria's GDP ranging from 20% to 36% for the prescribed period. This percentage is a significant figure and indicates the importance of this sector in Nigeria's economy.

4.3. Data and methods

For this study, annua data was obtained from obtained from World Bank's world development indicators for the a 30 year period (1991-2020).The variables include Nigeria's GDP (Constant 2015 US$), Agriculture, forestry, and fishing value added, Industry (including construction) value added (Constant 2015 US$), Services value added (Constant 2015 US$) and Exports of goods and services (Constant 2015 US$). The definition of the mentioned variables are as follows

GDP at purchaser's price refers to the sum of gross value added by all producers residing in a country plus any product taxes and minus all subsidies that are not included in the value of the products. GDP is computed without making deductions for depreciation of fabricated assets or for degradation and depletion of natural resources. Data for GDP are in constant 2015 prices and are expressed in U.S dollars. Dollar figures for Gross domestic product are converted from domestic currencies applying or using 2015 official exchange rats. An alternative conversion factor is utilized for countries where the official exchange rate does not reflect the rate effectively applied to foreign exchange transactions (World Bank national accounts data, and OECD National Accounts data files, 2022).

Agriculture, forestry, and fishing corresponds to ISIC divisions 01-03 and comprises of forestry, fishing, hunting, livestock production and crop cultivation. Value added refers to the net output of a sector after all outputs have been summed up and intermediate inputs subtracted. This figure is computed without making deductions for depreciation of fabricated assets or degradation and depletion of natural resources. The international Standard Industrial Classification (ISIC), revision 4, determines the origin of value added. Data are in constant 2015 prices and are expressed in U.S dollars (World Bank national accounts data, and OECD National Accounts data files, 2022).

Industry (Including construction) corresponds to ISIC divisions 05-43 and also includes manufacturing (ISIC divisions 10-33). Industry comprises of value added in mining, construction, manufacturing (reported as a separate group), water, electricity, and gas. Value added refers to the net output of a sector after all outputs have been summed up and intermediate inputs subtracted. This figure is computed without making deductions for depreciation of fabricated assets or degradation and depletion of natural resources. Data are in

constant 2015 prices and are expressed in U.S dollars (World Bank national accounts data, and OECD National Accounts data files, 2022).

Services corresponds to ISIC divisions 50-99. It comprises of value added in wholesale and retail trade (restaurants and hotels included), finance, transport, government and personal services for example real estate services, health care and education. Value added refers to the net output of a sector after all outputs have been summed up and intermediate inputs subtracted. This figure is computed without making deductions for depreciation of fabricated assets. The international Standard Industrial Classification (ISIC), revision 3, determines the origin of value added. Data are in constant 2015 prices and are expressed in U.S dollars (World Bank national accounts data, and OECD National Accounts data files, 2022).

Exports of goods and services refers to the to the value of all good and services produced and sold to the foreign market. Exports comprises of the value of freight, merchandise, Insurance, transport, license fees, royalties as well other services, such as, financial, construction, information, communication, personal, business and government services. Compensation of employees and Investment income and transfer payments are not included. Data are in constant 2015 US$.

4.3.1 Econometric procedure

The general formulation of the model in analytical form is as follows:

$$GDP \ = \ f \ (Ag, Ind, Serv, Exp) \tag{7}$$

Where: GDP (Constant 2015 US$) as a function of Agriculture, forestry, and fishing, value added (Constant 2015 US$); Industry (including construction), value added (Constant 2015 US$); Services, value added (Constant 2015 US$) and Exports of goods and services (Constant 2015 US$).

Econometric model:

$$GDPt = \beta_0 + \beta_1\_Agriculturt + \beta_2\_Industryt + \beta_3\_Industryt \quad\quad (8)$$
$$+ \beta_4\_Exportst + E_t$$

For this analysis, Ordinary Least Squares will be applied. The first step is to conduct a stationary test on the select variable to ascertain whether a unit root is present or not. Stationary tests are essential to be able identify whether the series is stationary or not, this is because variables which are not stationary are less successful in explaining a larger portion of the results that are interpreted and therefore can be misleading (Engle and Granger, 1987). To test for the presence of a unit root, Augmented Dickey–Fuller (ADF) test will be utilized. ADF test is commonly used as it accounts for serial autocorrelation (Dickey and Fuller, 1981). Augmented Dickey–Fullert test defines a null and alternative hypothesis. The null hypothesis considers the series to be non-stationary indicating the presence of a unit root while the alternative hypothesis indicates the absence of a unit root.

Hypothesis:

H0 = Series is not stationary = unit root is present in the series.

H1 = Series is Stationary = unit root is absent in series

α = 0.05

The selected level of alpha is 0.05. If the P value is less than 0.05, the null hypothesis will be rejected and the alternative hypothesis will be accepted as it shows that there is no presence of a unit root in the series and that it is stationary.

The table below shows that result of the stationary test using the level of variables and the log differences of the variables. A lag order of 1 was applied in the test.

Table 1 Unit root test

Variables	GDP	Agriculture	Industry	Service	Export
P value using level of variables	0.7997	0.8535	0.8894	0.6938	0.45
P value Using log difference of variables	0.0007958	0.0003594	1.102e-06 or 0.000001102	0.004303	3.903e-06 or 0.000003903

Source: Author's computation using Gretl, 2022

The result of the ADF test indicate that the selected variables are stationary when level of variable are employed with lag order of 1. When the log difference of the variables is used, all the variables appear to be stationary. For this study, the log differences of the variables will be used for the regression analysis because the variables are stationary, and this will lead to a more accurate result.

Table 2 Summary statistic of variables

```
                    Mean        Median      Minimum      Maximum
ld_GDP           0.074996      0.11045     -0.54360      0.29303
ld_Agriculture   0.079994      0.061276    -0.39864      0.66576
ld_Industry      0.065687      0.10650     -0.67174      0.41839
ld_Services      0.079114      0.10556     -0.51085      0.37474
ld_Exports       0.040162      0.093130    -0.72155      0.84236

                 Std. Dev.        C.V.      Skewness   Ex. kurtosis
ld_GDP            0.17338       2.3119      -1.6317       3.6742
ld_Agriculture   0.18331       2.2915       0.50365      2.9397
ld_Industry      0.23920       3.6415      -1.1615       1.4526
ld_Services      0.17405       2.1999      -1.2391       2.8965
ld_Exports       0.40362      10.050       -0.095108    -0.66123
```

Source: Author's computation using Gretl, 2022

Figure 18 Time series plot of selected variables

Source: Author's computation using Gretl, 2022

The second step is to conduct a **multicollinearity test.** The table below shows the correlation matrix of the five variables.

Correlation Coefficients, using the observations 1992 – 2020

5% critical value (two-tailed) = 0.3673 for n = 29

Table 3 Correlation Matrix

1d_GDP	1d_Agriculture	1d_Industry	1d_Services	1d_Exports	
1	0.8	0.9	0.9	0.7	**1d_GDP**
	1	0.5	0.6	0.4	**1d_Agriculture**
		1	0.7	0.8	**1d_Industry**
			1	0.5	**1d_Services**
				1	**1d_Exports**

Source: Author's computation using Gretl, 2022

The correlation matrix is utilized to determine if high multi-collinearity exist in the model. High multi-collinearity indicates a strong relationship between the exogenous variable i.e., Agriculture, Industry, Service and Exports. High multi-collinearity is said to be present when

correlation coefficient is greater than 0.8. The result indicates the absence of multicollinearity in the model.

4.3.2. Estimation of parameters using OLS

The results of the analysis using OLS regression as seen in the table below shows that P values of the exogenous variables; Agriculture, Industry and Service are less than the significant level of alpha 0.05. However, the parameter for export is seen to not be statistically significant. It can also be seen in the able below that the R-squared is 0.996179 and Adjusted R-squared is 0.99539. This result indicates that 99.6% of the variability of the GDP is explained by analysed relationship. The P value for the F test is 1.27e-28 which is less than the significance level of alpha 0.05. From a statistical point, given the high value of the R-squared, the model can be said to be good quality.

Table 4 OLS estimation

```
Model 1: OLS, using observations 1992-2020 (T = 29)
Dependent variable: ld_GDP

                    coefficient   std. error   t-ratio    p-value
  --------------------------------------------------------------------
  const            -0.00213002    0.00244392   -0.8716    0.3921
  ld_Agriculture    0.299013      0.0154545    19.35      3.79e-016 ***
  ld_Industry       0.258784      0.0203854    12.69      3.87e-012 ***
  ld_Services       0.455145      0.0207062    21.98      2.08e-017 ***
  ld_Exports        0.00496017    0.00949817    0.5222    0.6063

Mean dependent var    0.074996    S.D. dependent var    0.173382
Sum squared resid     0.003219    S.E. of regression    0.011581
R-squared             0.996176    Adjusted R-squared    0.995539
F(4, 24)              1563.009    P-value(F)             1.27e-28
Log-likelihood        90.88854    Akaike criterion     -171.7771
Schwarz criterion   -164.9406    Hannan-Quinn         -169.6360
rho                   0.008045    Durbin-Watson         1.965546
```

Source: Author's computation using Gretl, 2022

Given the figure above, the result of the estimation is:

$$1d\_GDPt = -0.00213002 + 0.299013t + 0.258784t + 0.455145t + 0.00496017t + \qquad (9)$$

et

After the parameters estimation has been done, econometric verification needs to be done which will involve a series of tests.

A test for autocorrelation will follow and it is first done by establishing two hypotheses.

H0: absence of autocorrelation in the model

H1: Presence of autocorrelation in the model

Significant level $\alpha = 0.05$

The autocorrelation test in the table below was conducted using Breusch-Godfrey test for first-order correlation. The P-value is 0.967 which is greater than the selected significance level of alpha 0.05. Therefore, the alternative hypothesis is rejected and the null hypothesis accepted because there is no presence of autocorrelation in the model.

Table 5 Autocorrelation Test

```
Breusch-Godfrey test for first-order autocorrelation
OLS, using observations 1992-2020 (T = 29)
Dependent variable: uhat

                  coefficient    std. error    t-ratio    p-value
  -------------------------------------------------------------------
  const           -1.85345e-05   0.00253434    -0.007313   0.9942
  1d_Agriculture   0.000200361   0.0164779      0.01216    0.9904
  1d_Industry      0.000165869   0.0211871      0.007829   0.9938
  1d_Services     -7.12884e-05   0.0212174     -0.003360   0.9973
  1d_Exports      -6.88861e-05   0.00983708    -0.007003   0.9945
  uhat_1           0.00972136    0.229207       0.04241    0.9665

  Unadjusted R-squared = 0.000078

Test statistic: LMF = 0.001799,
with p-value = P(F(1,23) > 0.00179887) = 0.967

Alternative statistic: TR^2 = 0.002268,
with p-value = P(Chi-square(1) > 0.00226796) = 0.962

Ljung-Box Q' = 0.00207789,
with p-value = P(Chi-square(1) > 0.00207789) = 0.964
```

Source: Author's computation using Gretl, 2022

The next test that will follow is the **normality test**.

Hypothesis:

H0: Normality of residuals

H1: No normality of residuals

Significant level $\alpha = 0.05$

Table 6 Normality Test

```
Frequency distribution for residual, obs 2-30
number of bins = 7, mean = 3.58908e-018, sd = 0.0115808

        interval            midpt   frequency     rel.       cum.

             < -0.015188  -0.018136        3     10.34%    10.34% ***
  -0.015188 - -0.0092925 -0.012240        4     13.79%    24.14% ****
 -0.0092925 - -0.0033967 -0.0063446       5     17.24%    41.38% ******
 -0.0033967 -  0.0024991 -0.00044879      4     13.79%    55.17% ****
  0.0024991 -  0.0083949  0.0054470       7     24.14%    79.31% ********
  0.0083949 -  0.014291   0.011343        2      6.90%    86.21% **
        >=   0.014291     0.017239         4     13.79%   100.00% ****

Test for null hypothesis of normal distribution:
Chi-square(2) = 1.583 with p-value 0.45316
```

Source: Author's computation using Gretl, 2022

The P value for the normality test is 0.45316 which is greater than significance level of alpha 0.05. Therefore, the null hypothesis of normality of residuals is not rejected and this result implies that sample data has been obtained from a normally distributed population.

A test for Heteroscedasticity would follow and the hypothesis are as follows:

H0: Homoscedasticity

 H1: Heteroscedasticity

Significant level $\alpha = 0.05$

Table 7 Heteroscedasticity Test

```
Breusch-Pagan test for heteroskedasticity
OLS, using observations 1992-2020 (T = 29)
Dependent variable: scaled uhat^2

                  coefficient   std. error   t-ratio   p-value
   -----------------------------------------------------------
   const             1.19080      0.200278     5.946    3.89e-06 ***
   ld_Agriculture   -1.44738      1.26649     -1.143    0.2644
   ld_Industry      -1.92265      1.67057     -1.151    0.2611
   ld_Services       0.238957     1.69686      0.1408   0.8892
   ld_Exports        0.806026     0.778372     1.036    0.3107

   Explained sum of squares = 5.05509

Test statistic: LM = 2.527546,
with p-value = P(Chi-square(4) > 2.527546) = 0.639710
```

Source: Author's computation using Gretl, 2022

The result of the test indicates that the P value= 0.63710 greater that 0.05. Therefore, the alternative hypothesis is rejected, and the null hypothesis is accepted as it implies that there is absence of heteroscedasticity in the model.

5. Results and Discussions

Agriculture is an essential part of several economies as it responsible for the provision of food as well job opportunities for the masses. Its products are consumed both domestically and internationally and exports of agricultural products brin in revenue which can be put into a country to foster economic development.

This study aimed at determining the impact of the agriculture sector on the GDP of Nigeria. This research showed that Agriculture accounts for 24.1% of Nigeria's GDP and is responsible for about 34.9% of total employment in the country (World Bank, 2021). Nigeria's major agricultural exports are cashew nuts, cocoa beans, and cotton. Among the mentioned exports, cashew nuts and sesame seeds are the most important as they account for over half of the nation's total agricultural exports (Oyaniran, 2020). OLS regression is a major part of this study and the variables which were considered include; GDP (Constant 2015 US$), Agriculture, forestry, and fishing value added, Industry (including construction) value added (Constant 2015 US$), Services value added (Constant 2015 US$) and Exports of goods and services (Constant 2015 US$). When the unit root test were conducted for the stated variables, the time series of the variables were not stationary when level of variables were used with Lag 1 so the log-difference difference of the variables needed to be used and then the data was seen to be stationary, the asymptotic p- value of the variables were as follows; GDP = -0.798266, Agriculture = =0.832381, Industry = 1.102e-06, Services = 0.004303, Exports = 3.093e-06. The statistical verification of the model indicated that multi-collinearity was absent, normality of residuals and an absence of absence of heteroscedasticity in the regression model. The result of the OLS regression indicates that a 1% increase in Agriculture value added will result to an increase in GDP by 0.29%; a 1% rise in value added by Industry leads to a 0.25% increase in GDP; a 1% increase in value added by services results in a 0.45% increase in GDP; and a 1% increase in the value by exports of goods and services leads to a 0.04% increase in GDP. The result of this regression analysis suggests that agriculture and service are of significance importance to the GDP of Nigeria. This result shows that the agricultural sector is essential for the economic growth of Nigeria. This sector should not be disregarded or paid little attention to or there will be an evident decline in Nigeria's economy given that that this sector absorbs a considerable proportion of the country's workforce. Several studies have been done regarding the relationship between agriculture and GDP, this study made reference to the works of authors both within Africa and outside Africa's borders. A study conducted by Potharla (2011)

sought to the co-integration between Gross domestic product and the Agricultural sector of India and the results revealed a long-run equilibrium relationship between India's GDP and its agricultural sector. Another study which was done was by Enu (2014),   The finding of this research is in agreement with the work of Enu (2014) who investigated on the impact of the agricultural sector on the economic growth of Ghana and the effect of the various sub-sectors of the agricultural sectors on Ghana's economic growth, the study revealed that the agricultural sector has a positive and significant impact on GDP growth and suggested that that this sector should not be neglected even in this present time where there is growing dependency on Oil as well as cocoa. A similar study which was done to determine the contribution of agriculture to the economic development of Ghana and the result showed a long-run relationship between overall GDP and Agricultural output. Moussa (2018) carried out research on Benin which is also a country in western Africa to determine if agricultural sector contributes to the economic growth of Benin and the study revealed a long-run relationship between agriculture value added and the GDP of Benin. These studies conducted which focused on countries in west Africa lay emphasis on the importance of this sector to the west-African economy, the result of their analysis agree with the findings of this study and this could be because the Ghana, Benin and Nigeria are all developing countries and also similar cultures and way of life given that they're both located in the western part of Africa.

The work of Rostow (1960) Identified stages that an economy needs to go through in order for it to develop, five progressive stages of development which every economy must undergo in order for it to develop. These stages of development include Traditional, Preconditions to Take-off, Take-off, Drive to Maturity and High Mass Consumption. In the first stage, a subsistent agriculturally based economy is predominant. The labour force is heavily involved in agriculture and the population is unaware of the development of science and technology. In the second stage, the country begins to develop manufacturing as well as a more national/international outlook instead of a regional outlook. The third stage (Take off) is characterised short period of intensive and also the advent of industrialization. Institutions and workers begin to gravitate towards the new industry. In the fourth stage, a rise in the standard of living can be seen, there is increase in the adoption of technology and a there is economic growth and diversification. In the last stage (High mass consumption), The living standards of people become even much better, the economy flourishes, and mass production and consumerism is evident in such an economy (Rostow, 1960). Nigeria can be said to be in its

take off stage as it is a developing economy which relies on agriculture as well as other sectors for the growth and development of the country. Nigeria is not so far away from reach the final stage which Rostow highlighted but for this to be done, certain measures and policies must be put in place in order to move towards this direction.

Fei-ranis model of economic growth which stresses on the existence of a dual economy consisting of both the modern and primitive sector (Sadik-Zada, 2020), sheds light on the importance of having a running and active agricultural sector. This study revealed that agriculture is of significance to the economy, and this agrees with Fei-ranis theory which suggest that sectors such as that of service and Industry are important but in order to achieve economic development, the agricultural sector needs to be given adequate attention and not overlooked. This theory further emphasis on the need for a transference of labour from the agricultural sector to other sectors for example the industrial sector. This is important for economy to grow but may negatively impact an economy if a large majority of the population do not longer want to take up agricultural related jobs. Although it may have its benefits, a fall in the productivity of the agricultural sector may lead shortages in the supply of food, raw materials and other products that are made available by an active participation in agricultural practices.

The benefits of agriculture can be derived by any country irrespective of whether it is a developing or developed economy. Agriculture is very essential as it ensures the economy is steadily supplied with food, which is needed for survival, nutrition and also for every individual to have the energy needed to add value to an economy. Food security is very important, and a functioning agricultural sector will help to achieve this. Agriculture is a lucrative sector, and the government generates revenues from agricultural production and it also provides employment opportunities for the masses. Agriculture is essential to the development of any economy and the next paragraph will provide policy recommendations on how agriculture can be used to contribute to growth and development including deescalating underdevelopment.

 The Nigerian government needs to invest in research and development of the agriculture sector. Science and technology are the driving force of economies and in order for agriculture to be better utilised to achieve economic growth and development. The government needs to treat is as a very important sector as it is seen to have a significant impact on the country's GDP. The government needs to encourage students with bright minds to produce ideas and topics which will aid in the advancement of agriculture in the nation. The government needs to

initiate policies that will support the income of farmers. To do this, they must be provided with the necessary farm equipment and inputs that will aid in increasing agricultural production and improve the quality of this products. With better quality, demand for domestic products increase and this will better the lives of the farmers and has a positive impact on the economy as individuals will not need to import certain agricultural products anymore since they can get better and more affordable agricultural items from home.

The Nigerian government needs to make this sector more attractive to the populace, for agriculture to grow, labour is required. By promoting employment in the agricultural sector, income generated from this sector will increase and a huge segment of the population who are without a job can have a way to earn a living. Training of farmers is also essential as they it will provide them with the required and more up-to-date knowledge on how to conduct their farming operations to lead to the most desirable result.

Development of Infrastructure is essential for agricultural sector to reach its full potential. Access to water, stable power supply and good transportation network are necessary to increase agricultural productivity. If the government decides to provide subsidies to farmers but if there inadequate infrastructure, achieving economic prosperity through agriculture might become a more difficult goal to attain.

6. Conclusions

Agriculture is undoubtedly an impact aspect of every economy, and it plays a dominant role in several developing countries in Africa such as Nigeria. Given the importance of this sector, it was important to investigate on the impact of agriculture on Nigeria's GDP and the results showed that agriculture is of high significance in the economy of Nigeria. Several indicators can be used to assess the economic health of a country but real GDP was used in this research as it a very good indicator in accessing the economic performance of a country.

Agriculture is a vital part of any economy as its activities ensures that food is made available to the masses. Food supply is essential for every economy to function. An economy might be advancing in technology or any other sector but if there are shortages of agriculture products, the negative effects of this will be seen across the country. A functioning agriculture sector will ensure food security. The population will be able to gain access to healthy foods enriched with nutrients which is essential to live a healthy and happy life. Agriculture is a means by which world hunger can be alleviated. A hungry population is never a happy and satisfied population. When people are unable to provide themselves with the healthy meals needed to carry on their day-to-day activities, they might resort to illegal activities, therefore, this sheds light on the importance of the agriculture to Nigeria and to the world at large. The agricultural sector is also a viable source of revenue for the government. Involvement in agricultural activities is avenue for the government to earn more revenue from the sale of agricultural products. These revenues which have been obtain from agriculture can be use the government to finance several developmental projects as well as advance the agricultural sector through provide better agricultural systems.

The agricultural sector is one of the biggest employers of labour in the country. Nigeria being the most populated country in Africa is home to over 200 million individuals, given this high numbers of individuals residing in the country, it is important that these people are provided with job opportunities that will allow them to earn income that enable them to provide themselves with the basic necessities of life such as food and shelter. Agriculture being a huge absorber of the labour force has provided individuals with this opportunity.

This study made mentioned on the works of several authors, in their study, they all stressed the impact the agricultural sector has on the economy of the country and that it needs to be better supported by the government. This study in order to in determine the impact of agriculture on

Nigeria's GDP, made use of annual data for the period of 1991 to 2020 and the chosen variables were GDP (Constant 2015 US$), Agriculture, forestry, and fishing value added, Industry (including construction) value added (Constant 2015 US$), Services value added (Constant 2015 US$) and Exports of goods and services (Constant 2015 US$). Regression analysis was employed in this study to determine the impact of the mentioned variables on Nigeria with aim of establishing if Agriculture plays a significant role in shaping GDP. The result of the analysis showed that a 1% increase in Agriculture value added will result to an increase in GDP by 0.29%; a 1% rise in value added by Industry leads to a 0.25% increase in GDP; a 1% increase in value added by services results in a 0.45% increase in GDP; and a 1% increase in the value by exports of goods and services leads to a 0.04% increase in GDP. The result showed that after the service sector, the agricultural sectors is the most important and there needs to be great attention paid towards this sector and it should not be treated as on with no or little importance. Given the result of the analysis, recommendations were provided, and they were as follows; The Nigerian government needs to invest in research and development of the agriculture sector. Science and technology are the driving force of economies and in order for agriculture to be better utilised to achieve economic growth and development. The Nigerian government must initiate policies that will support the income of farmers. To do this, they must be provided with the necessary farm equipment and inputs that will aid in increasing agricultural production and improving the quality of this products. With better quality, demand for domestic products increase and this will better the lives of the farmers and has a positive impact on the economy as individuals will not need to import certain agricultural products anymore since they can get better and more affordable agricultural items from home. The Nigerian government needs to make this sector more attractive to the populace, for agriculture to grow, labour is required. By promoting employment in the agricultural sector, income generated from this sector will increase and a huge segment of the population who are without a job can have a way to earn a living. Training of farmers is also essential as they it will provide them with the required and more up-to-date knowledge on how to conduct their farming operations to lead to the most desirable result. Development of Infrastructure is essential for agricultural sector to reach its full potential. Access to water, stable power supply and good transportation network are necessary to increase agricultural productivity. If these recommendations are considered by the government, agriculture which is seen to play a major role in the Nigerian economy will even bet of greater and more immense benefit to the growth and development of Nigeria.

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8. List of graphs and tables

8.1. List of tables

8.2. List of graphs

Appendix

Table A: Data for the period of 1991-2020 utilized in the analysis.

Year	GDP	Agriculture	Industry	Services	Exports
1991	151787193702	22608263493	65425663658	54254056203	20135326282
1992	158816751511	23136854874	69433859865	56143476437	14795732933
1993	155584641982	23570485890	64704529819	58153695272	17554871348
1994	152760898222	24174971952	60875081594	59243515278	17951860634
1995	152649894872	25041985448	59041800987	60412525496	16412261307
1996	159054968516	26025223590	62377161330	61923387417	14626927660
1997	163726571074	27108979849	63561546290	64178999835	21633809133
1998	167952769907	28176557178	63810789995	67166112762	22085223008
1999	168933827206	29614600391	61175600675	69855470651	19710467846
2000	177407437762	30479227845	65739154985	72195685921	22322698524
2001	187905850477	31635008246	69417867339	77530271181	17050178134
2002	216710230938	49217128085	70312008566	86355878387	19032667937
2003	232632354125	52665800564	78861886332	88560936777	25001543050
2004	254152145502	55963326964	80250901051	106271709946	24762848686
2005	270515773389	59919909001	81611505729	117570381443	27827137391
2006	286907481991	64361701709	80008689893	132113945318	47410660604
2007	305817928143	68995592821	78466358739	149098891856	39373980637
2008	326504898642	73320393997	76862400591	168483583439	56477031700
2009	352745852800	77632934910	78788250885	189421649654	39523893134
2010	380985472031	82157104571	82910799856	213810176054	44047664648
2011	401207892113	84552681417	89867917226	224279116714	55408753592
2012	418179231389	90221227295	92049638907	233180078950	53420148986
2013	446077370458	92870735971	94040566720	252728822621	41808469033
2014	474223597521	96836434656	1.00395E+11	270030620490	51878051598
2015	486803295098	100436737303	98143355464	282940891483	51923946713
2016	478932323772	104561419190	89457301146	280633731260	57911584063
2017	482791975286	108163781584	91376995421	278070292324	62972886455
2018	492074893436	110459669077	93086894603	283151439745	62084568960
2019	502942019448	113068998437	95239166938	289430243147	71382138449
2020	493917966761	115521909184	89670590153	282998149037	52135112985

Source: World Bank national accounts data, and OECD National Accounts data files, 2022.

Table B: Correlation coefficient for Log difference of GDP and Agriculture, forestry and fishing value added.

```
corr(ld_GDP, ld_Agriculture) = 0.79955316
Under the null hypothesis of no correlation:
 t(27) = 6.91747, with two-tailed p-value 0.0000
```

Source: Author's computation using Gretl, 2022

Table C: Augmented Dickey-Fuller Test for level of variable GDP

```
Augmented Dickey-Fuller test for GDP
testing down from 1 lags, criterion AIC
sample size 28
unit-root null hypothesis: a = 1

  test with constant
  including one lag of (1-L)GDP
  model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
  estimated value of (a - 1): -0.033999
  test statistic: tau_c(1) = -0.864968
  asymptotic p-value 0.7997
  1st-order autocorrelation coeff. for e: -0.016
```

Source: Author's computation using Gretl, 2022

Table D: Augmented Dickey-Fuller Test for level of variable Agriculture

```
Augmented Dickey-Fuller test for Agriculture
testing down from 1 lags, criterion AIC
sample size 28
unit-root null hypothesis: a = 1

  test with constant
  including one lag of (1-L)Agriculture
  model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
  estimated value of (a - 1): -0.0258773
  test statistic: tau_c(1) = -0.664978
  asymptotic p-value 0.8535
  1st-order autocorrelation coeff. for e: -0.004
```

Source: Author's computation using Gretl, 2022

Table E: Augmented Dickey-Fuller Test for level of variable Services

```
Augmented Dickey-Fuller test for Services
testing down from 1 lags, criterion AIC
sample size 28
unit-root null hypothesis: a = 1

  test with constant
  including one lag of (1-L)Services
  model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
  estimated value of (a - 1): -0.0409924
  test statistic: tau_c(1) = -1.16024
  asymptotic p-value 0.6938
  1st-order autocorrelation coeff. for e: -0.024
```

Table F: Augmented Dickey-Fuller Test for level of variable Industry

```
Augmented Dickey-Fuller test for Industry
testing down from 1 lags, criterion AIC
sample size 29
unit-root null hypothesis: a = 1

  test with constant
  including 0 lags of (1-L)Industry
  model: (1-L)y = b0 + (a-1)*y(-1) + e
  estimated value of (a - 1): -0.030891
  test statistic: tau_c(1) = -0.497631
  asymptotic p-value 0.8894
  1st-order autocorrelation coeff. for e: 0.234
```

Table G : Augmented Dickey-Fuller Test for level of variable Exports

```
Augmented Dickey-Fuller test for Exports
testing down from 1 lags, criterion AIC
sample size 29
unit-root null hypothesis: a = 1

  test with constant
  including 0 lags of (1-L)Exports
  model: (1-L)y = b0 + (a-1)*y(-1) + e
  estimated value of (a - 1): -0.170494
  test statistic: tau_c(1) = -1.66342
  asymptotic p-value 0.45
  1st-order autocorrelation coeff. for e: -0.067
```

Table H: Augmented Dickey-Fuller Test for Log difference of GDP

```
Augmented Dickey-Fuller test for 1d_GDP
testing down from 1 lags, criterion AIC
sample size 28
unit-root null hypothesis: a = 1

  test with constant
  including 0 lags of (1-L)1d_GDP
  model: (1-L)y = b0 + (a-1)*y(-1) + e
  estimated value of (a - 1): -0.798266
  test statistic: tau_c(1) = -4.15084
  asymptotic p-value 0.0007958
  1st-order autocorrelation coeff. for e: -0.078
```

Table I: Augmented Dickey-Fuller Test for Log difference of Agriculture

```
Augmented Dickey-Fuller test for 1d_Agriculture
testing down from 1 lags, criterion AIC
sample size 28
unit-root null hypothesis: a = 1

  test with constant
  including 0 lags of (1-L)1d_Agriculture
  model: (1-L)y = b0 + (a-1)*y(-1) + e
  estimated value of (a - 1): -0.832381
  test statistic: tau_c(1) = -4.3493
  asymptotic p-value 0.0003594
  1st-order autocorrelation coeff. for e: -0.037
```

Table J: Augmented Dickey-Fuller Test for Log difference of Industry

```
Augmented Dickey-Fuller test for ld_Industry
testing down from 1 lags, criterion AIC
sample size 27
unit-root null hypothesis: a = 1

  test with constant
  including one lag of (1-L)ld_Industry
  model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
  estimated value of (a - 1): -1.153
  test statistic: tau_c(1) = -5.58754
  asymptotic p-value 1.102e-06
  1st-order autocorrelation coeff. for e: 0.046
```

Source: Author's computation using Gretl, 2022

Table K: Augmented Dickey-Fuller Test for Log difference of Services

```
Augmented Dickey-Fuller test for ld_Services
testing down from 1 lags, criterion AIC
sample size 28
unit-root null hypothesis: a = 1

  test with constant
  including 0 lags of (1-L)ld_Services
  model: (1-L)y = b0 + (a-1)*y(-1) + e
  estimated value of (a - 1): -0.70065
  test statistic: tau_c(1) = -3.6884
  asymptotic p-value 0.004303
  1st-order autocorrelation coeff. for e: -0.127
```

Source: Author's computation using Gretl, 2022

Table K: Augmented Dickey-Fuller Test for Log difference of Exports

```
Augmented Dickey-Fuller test for ld_Exports
testing down from 1 lags, criterion AIC
sample size 28
unit-root null hypothesis: a = 1

  test with constant
  including 0 lags of (1-L)ld_Exports
  model: (1-L)y = b0 + (a-1)*y(-1) + e
  estimated value of (a - 1): -1.08151
  test statistic: tau_c(1) = -5.34026
  asymptotic p-value 3.903e-06
  1st-order autocorrelation coeff. for e: -0.027
```
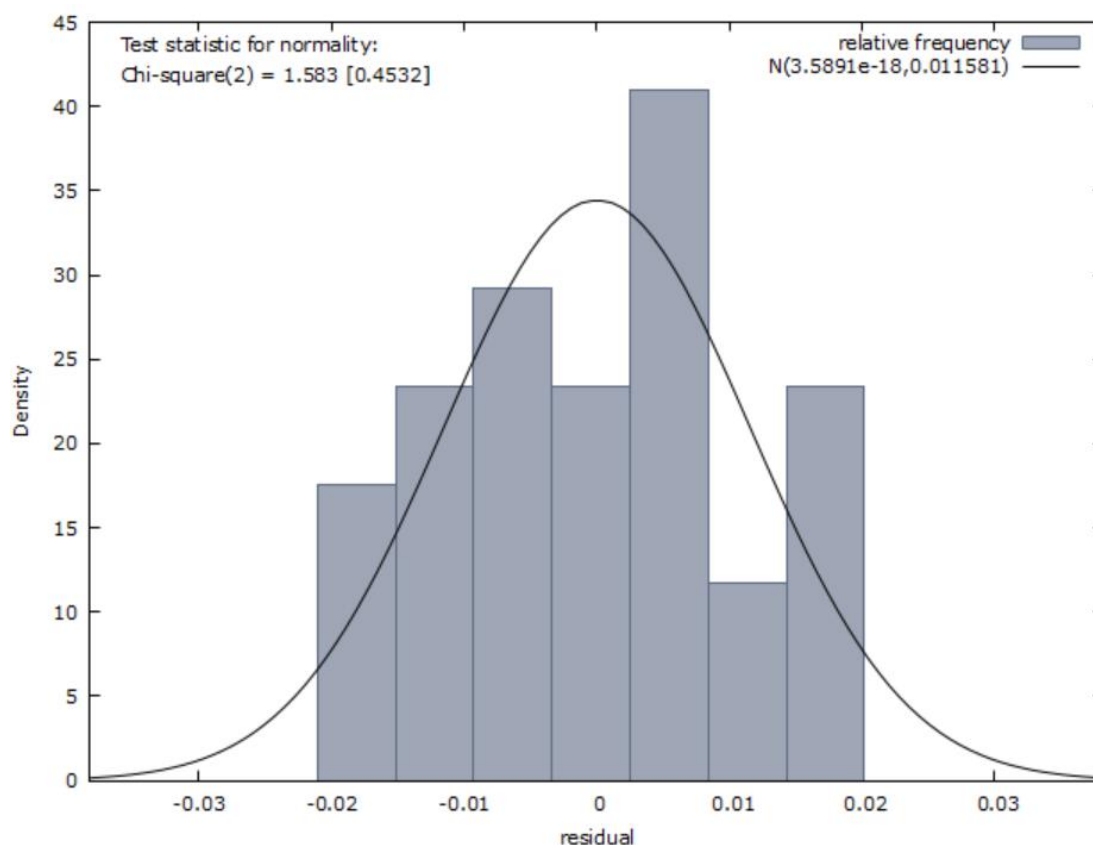
Source: Author's computation using Gretl, 2022

Graph 1: Normality test result

Source: Author's computation using Gretl, 2022

Table K: Augmented Dickey-Fuller Test for Log difference of Exports

COUNTRY	2000	2005	2010	2013	2014	2015	2016	2017	2018
Nauru	2.5	2.5	1.6	1.7	1.9	2.5	2.5	2.6	2.6
Nepal	3 755.3	4 576.6	5 230.8	5 782.5	6 045.4	6 112.0	6 125.8	6 444.4	6 624.0
Netherlands	10 914.3	11 372.4	12 448.2	12 359.4	12 927.3	13 195.7	13 489.6	13 553.2	13 208.8
New Zealand	6 916.3	7 691.0	6 378.4	7 310.4	7 694.7	7 961.8	7 979.1	7 493.9	8 128.5
Nicaragua	1 418.2	1 637.6	1 965.3	2 025.9	2 068.5	2 055.1	2 153.7	2 337.1	2 348.3
Niger	1 373.8	1 829.1	2 568.7	2 849.3	3 091.5	3 149.5	3 697.2	3 896.8	4 171.9
Nigeria	30 966.3	60 877.5	83 470.0	94 354.8	98 383.9	102 041.8	106 232.4	109 892.3	112 224.9
North Macedonia	863.6	906.5	1 004.1	932.0	961.1	979.0	975.2	844.0	801.9
Norway	3 733.9	4 423.9	5 617.6	5 873.8	6 277.9	5 931.9	5 574.9	5 809.7	5 823.0
Oman	679.6	716.6	872.5	1 020.3	1 377.5	1 491.6	1 621.8	2 075.0	2 385.9
Pakistan	43 365.1	48 238.5	56 006.5	60 756.7	62 273.5	63 600.0	63 697.9	65 014.2	67 491.2
Palau	10.7	9.7	9.3	9.0	8.5	8.2	8.8	9.6	9.1
Panama	1 269.9	1 587.2	1 392.8	1 476.1	1 504.8	1 507.0	1 518.7	1 528.1	1 542.7
Papua New Guinea	3 049.4	3 279.2	3 608.5	4 036.2	4 169.3	4 315.4	4 472.6	4 660.9	4 840.9
Paraguay	1 422.0	1 853.8	3 029.7	3 300.4	3 434.0	3 417.7	3 525.0	3 735.6	3 933.5
Peru	8 495.2	9 397.8	11 519.4	13 006.0	12 864.3	13 372.8	13 605.4	13 913.0	15 231.8
Philippines	20 872.6	24 905.0	27 657.0	29 505.5	29 999.7	30 039.1	29 674.3	30 851.0	31 125.9
Poland	9 543.2	11 351.9	11 316.8	11 407.4	11 486.6	10 513.3	10 830.2	11 101.8	9 687.2
Portugal	3 906.1	3 880.9	3 845.2	3 981.7	3 980.8	4 184.5	4 134.8	4 218.6	4 189.6
Qatar	96.1	95.4	166.0	193.6	242.2	260.9	284.4	307.7	333.4
Republic of Korea	23 930.8	23 687.5	27 306.2	28 021.5	29 445.4	29 372.7	27 717.8	28 342.5	28 767.3
Republic of Moldova	727.5	893.3	770.7	946.8	1 028.1	891.1	1 055.0	1 145.2	1 162.3
Romania	6 589.7	8 245.2	6 490.0	7 977.6	8 376.5	7 446.2	7 758.9	8 887.7	9 776.2
Russian Federation	37 962.6	43 010.8	42 350.2	49 892.1	51 515.9	52 754.8	53 947.6	54 759.5	53 639.6
Rwanda	1 059.1	1 415.9	1 798.0	2 070.5	2 208.1	2 317.7	2 407.6	2 566.3	2 716.6
Saint Kitts and Nevis	7.0	11.9	9.5	9.6	9.7	9.5	8.7	11.0	11.4
Saint Lucia	61.7	36.0	27.1	32.6	28.9	30.3	30.5	28.9	30.5
Saint Vincent and the Grenadines	43.7	42.5	44.5	47.5	48.8	47.1	50.2	52.5	53.9
Samoa	104.3	87.7	69.8	68.1	68.6	69.9	74.9	80.2	70.2

Source: FAO, 2020