Czech University of Life Sciences Prague

Faculty of Engineering

Department of Trade and Business Dealing With Machinery

Diploma Thesis

ANALYSIS OF BIOFUEL UTILISATION IN NIGERIA

Adetola Adebayo Adebanjo

Czech University of Life Sciences Prague

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Diploma Student: Adebayo Adebanjo Adetola

Supervisor:prof.Ing.David.Herak,Ph.D

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DIPLOMA THESIS ASSIGNMENT

Adebayo Adetola

Trade and Business Dealing with Machinery

Thesis title

Analysis of biofuel utilization in Nigeria

Objectives of thesis

The aim of this thesis is to analyse biofuel utilization in Nigeria. The case study, which will analysed to identify the major problems that exist and to suggest solutions to these problems, will be integral part of this thesis too.

Methodology

Researcher will identify the problems and select the major problems in the case. Hereafter the suggested solutions to these major problems, recommendation of the best solution, and details how this solution should be implemented will be described. The results of this study must be appropriately analysed.

The proposed extent of the thesis

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Abila, N. (2010). Biofuels adoption in Nigeria: a preliminary review of feedstock and fuel production potentials. Management of Environmental Quality: An International Journal, 21(6), 785-795.

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The Diploma Thesis Supervisor

doc. Ing. David Herák, Ph.D.

Supervising department

Department of Mechanical Engineering

Electronic approval: 24. 3. 2016

doc. Ing. Pavel Neuberger, Ph.D.

Head of department

Electronic approval: 24. 3. 2016

prof. Ing. Vladimír Jurča, CSc.

Dean

Prague on 31. 03. 2017

Declaration

I declare that I have worked on my diploma thesis titled “Analysis of biofuel utilization in Nigeria” by myself and I have used only the sources mentioned at the end of the thesis.

In Prague on date _____signature_____

Adebayo Adetola

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I would like to thank God Almighty, my supervisor , **prof. Ing. David Herák, Ph.D, Olaosebikan Layi Akangbe, M.Sc, prof. Kamalu Ejiogu, O. C, Ph.D of Seed Industry Development Department, National Agricultural Seeds Council of Nigeria,** and all other persons,for their advice and support during my work on this Thesis.

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ANALÝZA VYUŽITÍ BIOPALIVA V NIGÉRII

ANALYSIS OF BIOFUEL UTILISATION IN NIGERIA

Souhrn

Vzhledem k antropogenním emisím skleníkových plynů, jako CO_2 z výroby a používaní fosilních paliv a také kvůli obavám o energetickou bezpečnost se vývoj obnovitelných zdrojů energie šetrných k prostředí stalo celosvětovou záležitostí.

V automobilovem průmyslu, tepelné a elektrické výrobě začínají fosilní paliva postupně nahrazovat biopalivem. Navzdory Nigerijské biopalivove politice zavedené v roce 2007, existují problémy spojené s výrobou a využitím biopaliv v Nigerii. Konkrétné různé problémy vznikající u pěstování základních potravin a orne půdy, když odklonením na biopalivovou výrobu vznikalo mnoho negativních dopadů na lidi, ekonomiku, životní prostředí a způsob výroby biopaliva.

V důsledku oznámených aktivit v oblasti biopalivové výroby a biopalivových surovin, jako je například bio-ethanol a biodiesel v některých částech Nigerie, byly komunitán zapojených kolem výrobních závodů odebrány vrobky s dotazníkem pro získání představy o účincích využití biopaliv a vjemy byly statisticky analyzovány. Otázky související s využitím biopaliv v Nigerii byly kontrolovány tak($p<0.05$),aby určily hlavní problémy a nabídly jejich řešení.

Klíčová slova: Biopaliv, Surovina, Energie, Nafta

Summary

Due to the emission of anthropogenic greenhouse gasses (GHGs), such as Co_2 from the production and use of fossil fuels and also concerns about energy security, the development of renewable energy which is environmental-friendly has become a global concern.

In automotive, thermal and power generation, biofuel is gradually being adopted as an alternative to fossil fuel. Despite the Nigerian Biofuel Policy introduced in 2007, there are problems associated with the production and utilisation of biofuel in Nigeria.

Various problems arises from the effects on arable land and staple foods, which if diverted for biofuel production has a lot of diverse effects on people, economy, environment and production pathway.

As a result of reported activities in biofuel feedstock and biofuel production, such as bio-ethanol and biodiesel in some parts of Nigeria. The communities involved and around the production sites were sampled with a questionnaire to obtain perceptions of the effects of biofuel utilisation and the perceptions were statistically analyzed, questions revolving around problems associated with biofuel utilisation in Nigeria were checked for significant($p<0.05$), so as to identify the major problems and solutions proffered to these problems.

Keywords: Biofuel, Feedstock, Energy, Diesel

CONTENTS

List of Figures

List of Tables

LIST OF ACRONYMS

NNPC- Nigerian National Petroleum Corporation

NIYAMCO- Nigerian Yeast and Alcohol Manufacturing Company

IEA- International Energy Agency

NGC- Nigerian Gas Company

PPM- Petroleum Product Marketing

NAPIMS- National Petroleum Investment management Services

DPR- Department of Petroleum Resources

REEP- Renewable Energy and Energy Efficiency Partnership

GHG- Greenhouse Gas

LFN- Laws of the Federation of Nigeria

CBN- Central Bank of Nigeria

FAO- Food and Agriculture Organization

UNFCCC- United Nations Framework Convention on Climate

ECOWAS- Economic Community for West African States

VOC- Volatile Organic Compounds

GBL- Global Bio-fuels Limited

SME- Small and Medium sized Enterprise

STF- Science Technology Forum

FAM- Fatty acid Methyl Esters

SVO- Straight Vegetable Oil

PPO- Pure Plant Oil

FFV- Flex Fuel Vehicle.

CNG- Compressed Natural Gas

ONGS- Oil and Natural Gas Corporation

SI UNITS	SYMBOLS
Liters	l
Tons	t
Watts	w
Hectare	ha
Kilometers	km
Density	kg/m^3
Volume	m^3
Specific density	kg/l

1.0 INTRODUCTION

A biofuel is a fuel that is produced through contempoary biological processes, such as agriculture and anaerobic digestion. Biofuel can be obtained directly from plants or indirectly from agriculture, comercial, domestic and industrial wastes. They are renewable sustainable energy in which countries are exploring globally due its advantages , such as environmental benefits, avialability and sustainability.

Nigeriais is a country in West Africa, which has a population of 173 million people. Nigeria's economy depends majorly on petroleum, yet the country experiences fuel supply shortage due to vandalism of oil facilities, unavailability of working refineries and poor maintenance culture.

Currently, Nigeria is the fifteenth largest producer and sixth largest exporter of petroleum. The country has a proven reserve of 36.22 billion barrels of crude oil and 187 trillion sef of natural gas.

Due to fuel delivery difficulties in Nigeria, Nigeria decided to explore the bio-fuel sector by releasing the Nigeria Bio-fuel Policy and Incentives in 2007 to create conducive investment environment for the productive passage of Nigeria into bio-fuel sector.

The promise of economic multiple social, ecological and geopolitical benefits has caused a recent increase in biofuel investments and production volume and as well pushed key producer and consumer countries to establish policies and incentives that would further develop the biofuel industry (Timilsina and Shrestha, 2010).

The increase in the demand for biofuel products has further created an increase in the production of feedstock in rural communities.

It was reported that the number of Nigerians on poverty line is on a yearly increase and the largest proportion emerges from the rural areas (Agba et al., 2010). Most rural dwellers engage in farming, producing biofuel feedstock and biofuel as a means of livelihood. Nigeria is blessed with abundance of fertile lands. The rural areas has a lot of biofuel producing resources such as cassava, oil palm, coconut, maize, rice, jatropha seeds among others.

However, there are serious issues concerning biofuel utilisation in Nigeria. There are issues based on the perception that biofuel production will lead to substitution of food

for fuel and agricultural land for fuels (Galadima et al. , 2011), technical capability, long term ecological impact, domestic and industrial application of biofuel, policy problems . economic benefits, water availability (Shah et al. ,2000), deforestation (Morton et al. , 2006). An analysis done by Cotula et al. , (2008), illustrates the negative effects of a large scale commercial production as a result of limited access to land and water and unwanted land seizures.

An examination of the positive or negative impacts of biofuel production on livelihoods, application, land use and acquisition, biophysical environment, Economy and availability of food gives an insight to the problems associated with the use of biofuel in Nigeria and finding solutions that will prevent those problems.

This study was carried out on areas in South East, North East, South West and North Central zones of Nigeria where bio-ethanol productions and vegetable oil fuel has been reported.

2.0 CURRENT STATE OF BIOFUEL PRODUCTION AND UTILISATION IN NIGERIA

The generation of biofuel in Nigeria is yet to experience a widespread growth in Nigeria.There has been tremendous efforts to educate ,train,and promote the production of biofuel as well encourage the full utilisation of biofuel in Nigeria.

Nigeria is currently facing alots of issues as regards the use of fossil fuels such as petroleum et.c.

Various problems Nigeria is currently facing are:

1)The insecurity supply of fossil fuels.

2) Ever increasing cost

3) Global warming evidences

- Desertification
- Weather variability

4) Carbon Emission

5) Air pollution

- Gas flaring at the exploitation platforms
- Incomplete combustion automobile and generators

6) Prevalence of rural poverty

7) Poor infrastructure

8) Under utilisation of arable lands

9) Declining revenue from oil

All these problems points to the fact that ,there is need for an alternative.

Some biomass energy projects in Nigeria includes:

1) Epe Integrated Solid waste Management Project,

2) Gas to Energy Projects at Olushosun Landfill site in Lagos State,

3) Waste- To -Energy Plant at Ikoyi Market,

4) Compost at Ikorodu for treatment of market waste,

5) Biofuel production complex at Ilemeso Ekiti State that lie between latitudes 7°N and 14°N(Ondo,Kwara, Osun, Oyo, Kogi, Kaduna, Kano, Zamfara, Plateau, and Nasawara states)by Global Bio-fuels Ltd,

6) Sugar based bio-fuel plants at Girei and Demsa Local Government Areas of

Adamawa State by Renewable Energy Program Office, Adamawa State and Green Carbon Afrique with the intent to produce enough sugarcane for local use, export, ethanol, and electricity generation.In the production of biofuel, the primitive and ancient methods are mostly used in Nigeria due to low pace of development in Nigeria.Fuel wood still constitutes the major source of cooking fuels for the rural and even the urban populace.

According to the facts established by Newson(2012),(Nwofe,2013), they both established that „Nigeria contributes about 10 percent global annual deaths from smoke related illness caused by indoor and outdoor pollution due to overdependence on biomass for cooking fuels".

The Federal government of Nigeria is doing alot, so as to encourage the utilisation of biofuel in Nigeria ,through The Federal Ministry Ministry of Environment .The Federal Ministry of Environment on the 20th October 2010 showcased global biofuels project as a flagship renewable energy concept during its Renewable Energy Program,themed: "Scaling up Renewable Energy Development in Nigeria" held in Abuja.[1]

Global Bio-fuels is developing a bio-fuel production refinery using sweet Sorghum ,one of the most promising food stocks, which does not compete with food chain.

The Federal Ministry of Environment said: "is happy to be in partnership with GBFL and look forward to assisting the company to achieve its goals of establishing 10 sweet Sorghum refineries at different locations across Nigeria"[2].

It is only in Lagos State wastes are presently sustainably managed. Waste management in Lagos is managed by a body known as Lagos Waste Management Authority.

Waste are gradually been properly managed in Lagos state for conversion to energy use. There are various places set aside for dumping biomass, such as Landfills in Epe and Lagos Olushofun. Various wastes from domestic, medical, commercial industries are found in such dumpsites.

Based on statistics, Lagos generates up to 7000 tons on daily basis.

2.1 Bio-fuels Development in Nigeria

[1]Global Biofuels limited[online].2010[cit2 015-12-05].Source:http://www.globalbiofuels.org/news/environ.html

[2]Global Fuels Limited[online].20-10-2010[cit 2015-12-05]. Source: http://gbl.ng/index.php/federal-ministry-of-environment-showcase-global-biofuels-project-as-a-flagship-renewable-energy-idea/

Though combustible renewable primary fuels (IEA, 2007), are the traditional energy sources in Nigeria, there has been a gradual shift and adoption of the first and second generation bio-fuels.

Bio diesel, bio ethanol and bio gas which are first set of bio fuels (Naik et al., 2010) are mainly derived from good sources or current food materials such as, Maize, Soya bean, Oil palm, Sugar cane, and cassava for ethanol or bio diesel production.

The second generation bio fuels are mainly sourced from non-edible sources such as Jatropha, Algae (Naik et al. 2010).

The first set of or generation of bio fuels such as the crude ethanol or edible ethanol are already been produced at a non-commercial and commercial level in Nigeria.

Ethanol production is part of traditional livelihood systems in the Niger Delta area and extending to some part of the south western states of Nigeria.[3]

In recent times there has been an increase in demand for products needed for the production of bio fuels. This is an indication, that bio -fuels utilization in Nigeria is beginning to gain momentum and in the nearest future, it will replace the old sources of energy. Ohimain (2010) posited that the market demand for ethanol in Nigeria is estimated to be 5.14 billion liters per annum. While the demand for diesel based on estimation is at 480 million liters per annum (NNPC, 2007).

Based on statistics, the total installed capacity of ethanol is about 134 million liters per annum. The production of 90 million liters can be met by the manufacturing sector, if they operate at 100% capacity.

Due to technical difficulties, logistical reasons, unstable power supply, frequent break down of equipments due to poor maintenance culture, seasonal availability and instability in price of feedstock, factories are unable to operate efficiently.

Presently, not all the plants are fully operational. There is a shortfall of over 5 billion liters per annum, based on the current domestic ethanol production. The majority of the production is produced by UNIKEM and international distilleries (118.6 million liters representing nearly 90% of the total production). They rely on crude ethanol precursors,

[3] Abila, N. Energy policy 43 [online](2012) 387-395 [cit 2015-12-05]. source : http: //wwwelsevier.com/locate/enpol

mostly imported from Brazil. This simply implies that their feedstock is not locally obtained and thus hindering Nigerian farmers opportunity to grow business wise. Also Dura clean, which recently acquired the former Nigeria Yeast and Alcohol Manufacturing Company (NIYAMCO), is yet to commence operations fully.

The subsidiaries of the NNPC; DPR, National petroleum investment management services (NAPIMS), the three domestic refineries, the Petroleum Products Marketing Company (PPMC) and the Nigerian Gas Company (NGC), have been a vital figure towards the take off of a domestic fuel ethanol industries.

The DPR performs regulatory role, NAPIMS market the investment, while the three domestic refineries refine petroleum products producing gasoline among other products.

The receiving of bio-ethanol blending with gasoline and distribution of gasohol to the consumers are done by PPMC, while the supply of gas to power some of the emerging bio-refineries especially those located in Sango Ota, Ikeja etc, due to the availability of gas supply pipeline facilities and other handling equipments is done by the NGC.

The Nigerian National Petroleum Corporation said that "Nigeria to earn $150million from bio-fuel initiative annually". This was in a lecture titled "Energizing Agriculture through Gross Sectorial linkages with Oil and Gas Industry" delivered by the Group Managing Director of NNPC, Engineer Funsho Kopolokum at the convocation ceremony of the Federal University of Agriculture, Makurdi, recently[4].

He stated that the bio-fuel project which is part of the country's alternative energy development strategy is focused towards utilising Nigerian agricultural potential in Cassava and Sugarcane to produce ethanol that can serve as a good alternative to petrol current use.

Funsho [2015] explained that two types of automotive fuel are to be developed, namely ethanol and fuel and palm oil diesel. He explained that ethanol was derived by removal of glycerin through chemical process and can be used in concentration with petroleum based diesel fuel with little or no modification. He also stipulated that NNPC had secured a grant of 70,000 Euros from Renewable Energy Efficiency Partnership

[4]Nigerian National Petroleum Corporation [online].2015[cit 2016-02-11] Source: http://http://www.nnpcgroup.com/PublicRelations/NNPCinthenews/tabid/92/articleType/ArticleView/articleId/204/Nigeria-To-Earn-US-150m-From-Bio-fuel-Initiative-Annually.aspx

(REEEP) from Germany to support detailed feasibility study at the target locations.

He explained that the corporation is inviting a research proposal for immediate review based on the fact that the demand for global energy is on the increase and that Nigeria oil and gas sector is ready to meet the demand call.

The Nigerian National Petroleum Corporation (NNPC) has commenced 6 bio-ethanol and 3 bio-diesel projects nationwide through her Renewable Energy development (RED). The 6 bio-ethanol projects which has a common name called Automotive Bio-fuel Project has to do with construction of integrated ethanol refineries and feedstock farm. Four out the six bio ethanol projects and the remaining two are located in the Northern and Southern part of Nigeria respectively.

The four situated in the Northern part of Nigeria will use sugarcane feedstock, while the two situated in the Southern part will use cassava feedstock.

There will be a production of 75 million liters/year ethanol from the three of the sugarcane projects, 116,810 metric tons sugar and generate 59 Megawatts of green electricity from 1.8 million tons of sugarcanes.

There is already an acquisition of 20,000 hectares each for the three sugarcanes projects but 16,000 ha will be cultivated according to information.

There will be a production of 40 to 60 million liters from the two NNPC cassava based feedstock bio-ethanol plants and 8.53 MW green electricity per annum using cassava obtained from a 15,000 ha farm.

There has been an effective response to the growing demand of bio fuel in Nigeria through various investments in fuel ethanol and bio diesel production as highlighted or indicated at the beginning of this chapter. The bio diesel project includes: Biodiesel Nigeria Limited initiative in Lagos State. The current production of ethanol in Nigeria is represented in Table 1 below.

Table1. Current ethanol production in Nigeria

Name of Company	Plant location	Feedstock	Installed capacity (million L/year)
Alconi /Nosak[a]	Lagos	Crude ethanol(imported)	43.8
UNIKEM[b]	Lagos	Crude ethanol(imported)	65.7
Intercontinental Distilleries	Ota-Idiroko	Crude ethanol(imported)	9.1
Dura clean(formerly NIYAMCO)	Bacita	Molasses/Cassava	4.4
Allied Atlantic Distilleries ltd (AADI)	Sango-Ota	Cassava	10.9
Total			**133.9**

Source: http://www.journals.elsevier.com/energy-policy

3.0 STUDY OBJECTIVES

The production of bio-fuels and its utilisation is no more a new technology. Bio-fuels gained global momentum when governmental interventions started to drive accelerated developments, adoption and utilisation through various policies that enhanced the developments of bio-fuels.

Various countries have promoted bio-fuels by enacting a compulsory blending rate with gasoline or diesel, and regional bodies around the world have also contributed towards its usage.

The main objective of this study is to analyse biofuel utilisation in Nigeria. The case study will be analysed to identify major problems that exist and to suggest solutions to these problems as an integral part of this thesis.

This study specifically tends to answer the following major research questions in which major problems associated with biofuel utilisation in Nigeria revolves.

This case study will specifically answer the following questions.

1. Has the domestic application of biofuel increased in the last two years?
2. Has the industrial application of biofuel increased in the last two years?
3. Fast conversion of arable land for feedstock cultivation?

4. Are more investors getting large areas of land for cultivation of biofuel feedstock?

5. Do you think in future there will be a decline in the availability of land used for planting food crops needed for consumption as a result of feedstock production?

6. Biofuel production activities have caused environmental pollution?

7. Irrigation used for feedstock is affecting water availability?

8. Are plants used for producing biofuel reducing soil nutrients on land?

9. Are farmers well oriented about cropping culture?

10. Do you think the adoption of biofuel would reduce the level of unemployment in Nigeria?

11. The Nigerian biofuel policy has been beneficial to Nigeria in the area of food security, job creation, environmental protection, provision of energy and water conservation?

12. Biofuel companies having access to financial assistance in purchasing biofuel producing engines?

13. Are there scarcity of food crops for consumption as a result of biofuel feedstock cultivation?

14. Do you think Nigeria has enough technical know-how on biofuel production?

4.0 MATERIALS AND METHODS

4.1.Study regions and basis for selection

Geographic zones selected for data collection were areas where activities relating to feedstock and biofuel production have been reported. Areas selected were South -West (S-W), North East (N-E), South East (S-E), and North Central (N-C).

4.2. Collection of data and preparation

Geographical zones where biofuel production and feedstock cultivation exist were selected for sampling. A well detailed questionnaire with summarized questions relating to biofuel utilisation was randomly distributed to the sampled population. Most of the respondents were categorised into “Yes”, ”No” and “Undecided” while others were assigned numerical value and numerical codes equal to the frequency of occurrence of each of the categories (Acheampong and Campion, 2014).

4.3. Data Analysis

Based on approach by Ogbo et al. , (2013), the demographic information of the res-

pondents were analysed. SPSS and Chi-Square were used in analyzing the assigned numerical codes from the questionnaire to obtain descriptive statistics and frequencies (Acheampong and Campion 2014) in determining perceptions of effects of the sampled zones and used in testing for the level of significance.

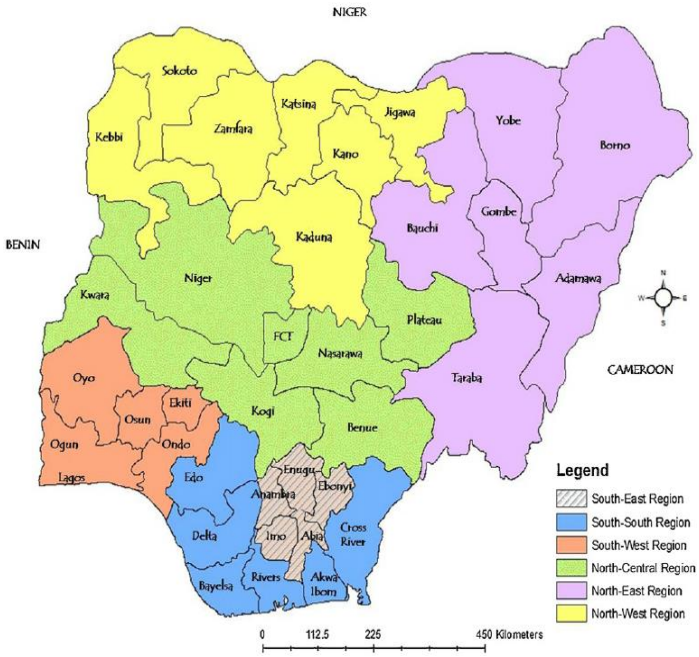
Excel was also used to generate charts such as Pie chart and 2D Column chart for clarity.

The following formats were used:

SPSS-Analyze-Descriptive Statistics-Frequency

SPSS-Analyze-Non parametric test-Legacy tools- Chi-Square

Figure.1 Geopolitical regions of Nigeria



Source: https://www.researchgate.net/figure/51795009

5.0. RESULTS AND DISCUSSION

5.1. Selected States and Regions for sampling

As illustrated in Figure 1, the selected states and their goepolitical regions are shown in Table 2 below.

Table.2 Selected States

States	Regions
1.Osun	**South West (S-W)**
2. Oyo	**South West (S-W)**
3. Ogun	**South West (S-W)**
4. Imo	**South East (S-E)**
5. Kwara	**North Central(N-C)**
6. Benue	**North East(N-E)**
7.Abia	**South East (S-E)**

5.2. Results from the questionnaire

100 copies of the questionnaire were printed out and randomly distributed in those four regions. A total of 35 copies were returned from those regions due to various limitations which will be further discussed in this thesis.

5.3. Demography

Farming activities which involves the planting of feedstock were observed to be dominated by male considering the number of percentage of males (85.7%) to the number of percentage of females (14.3%) in Table 3 and in which majority of the acquired land were by inheritance.

This observation according to Balogun and Salami, (2015)"was explained by the strong patrillineal societies, where allocations of land is by lineage authority to the household male head (Nnadi et al., 2012); and religio-cultural peculiarities of the core North in which women are subjected to their husband(Kritz and Makinwa-Adebusoye, 2006)".

Respondents ages ranged from 14-19 to >55. A level of maturity was observed from the respondents with majority of them having ages between 20-30 >55. This specifically indicated their capability to respond to questions. Respondents with ages ranged from 20-30 had the highest responses, which specifically suggest most youths now engage in farming as an alternative means of income due to high level of unemployment.

Table.3 Demography distribution

Demographic factors	Categories	No of respondents (NR)	%	Total (NR)	Total (%NR)
Sex	Male Female	30 5.0	85.7 14.3	35	100
Age Group	14-19 20-30 31-44 45-55 >55	1.0 12 6.0 9.0 7.0	2.9 34.3 17.1 25.7 20.0	35	100
Occupation	Farming Student Civil Service Self-employed Retiree Private - sector Others	30 1.0 1.0 2.0 0.0 1.0 0.0	85.7 2.9 2.9 5.6 0.0 2.9 0.0	35	100
Educational qualification	Primary Secondary Tertiary Post-tertiary No Formal - Education	9.0 9.0 16.0 1.0 0.0	25.7 25.7 45.7 2.9 0.0	35	100

All the respondents had one form of education or the other, which suggest thier ability to read and write.

Figure.2 Age distribution of the respondents

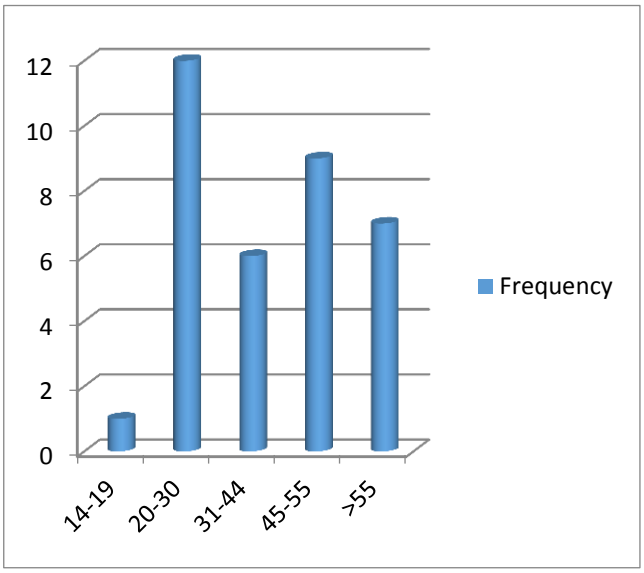


Figure.3 Educational level of the respondents

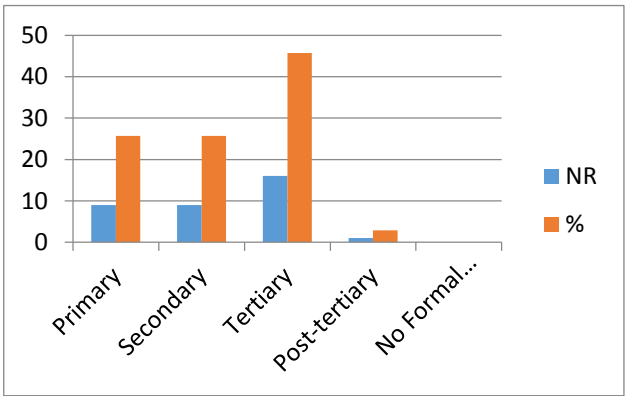


Table. 4 Quantities of biofuel feedstock used between 2014 and 2015 (Kg).

Feedstock	2014(Kg)	2015(Kg)	Total(Kg)
1.Maize	2000	2500	4500

2. Cassava	9,577	10,826	20,403
3. Oil palm	96,647,500	89,026,560	185,674,060

Table.5 Quantities of biofuel sold in 2014 and 2015 (litres).

Biofuel sold	2014(litres)	2015(litres)	Total(litres)
1.Ethanol	6,120	6,600	12,720
2. Vegetable oil	15,536,000	31,020,000	46,556,000
3. Other	2,000	1,350	3,350

From observation the farmers produce maize, cassava and oil palm as feedstock used for producing ethanol and vegetable oil fuel.There was an increase with the quantity of Maize and Cassava used in producing ethanol between 2014 and 2015 as shown in Table 4 ,which suggest an increase in demand for ethanol. While there was a decline in quantity of Oil palm used in producing vegetable oil fuel but with an increase in quantity of vegetable oil sold within two years. This simple explains that the reduction in quantity of oil palm is unconnected with the increase in vegetable oil fuel . Increase in demand for vegetable oil might be connected with the preference for diesel engine type. From the data gathered, 91.4% of the respondents believed the prefered engine type in Nigeria is diesel, 2.9% of the respondents believe its petrol while 5.7% of the respondents did not decide.

Reasons for this might be attributed to the fact that most diesel engine are suitable for use with straight vegetable oil (SVO), commonly called pure plant oil (PPO), with certain modification. Vegetable oil are also widely used in Nigeria for industrial and domestic cream production. It is also used as locative grease in vehicles.

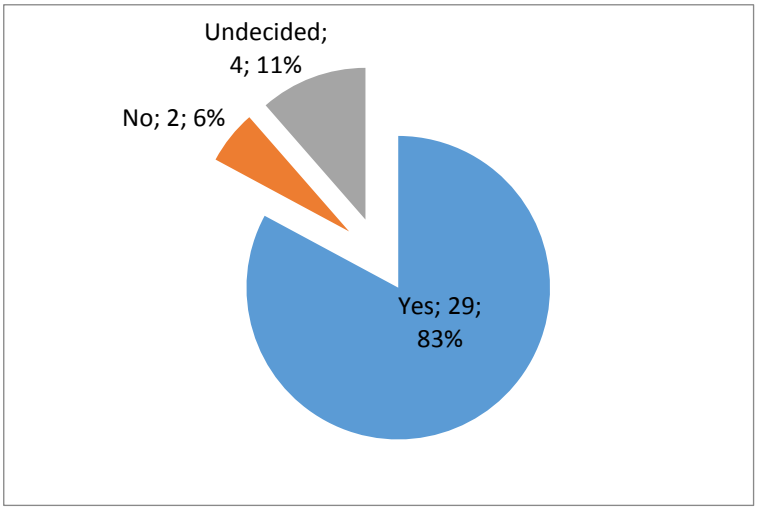
5.4 Biofuel Application

Question.1 Has the domestic application of biofuel increased in the last two years?

Table.6 Biofuel application (Question 1).

Categories	Number of Respondents (NR)	%
Yes	29	82.9
No	2	5.7
Undecided	4	11.4
Total	35	100.0

Figure .4 Pie Chart on biofuel application (Question 1).



Chi-Square Test (Question1)

Asymp.Sig.	,000	P-Value 0.000	p<0.05

level of significant (p<0.05). Where ∝ =0.05= level of significance

P= probability Asymp.Sig. = Asymptotic significance= p-Value

P<0.05 (Statistically significant)

p>0.05 (Not statistically significant)

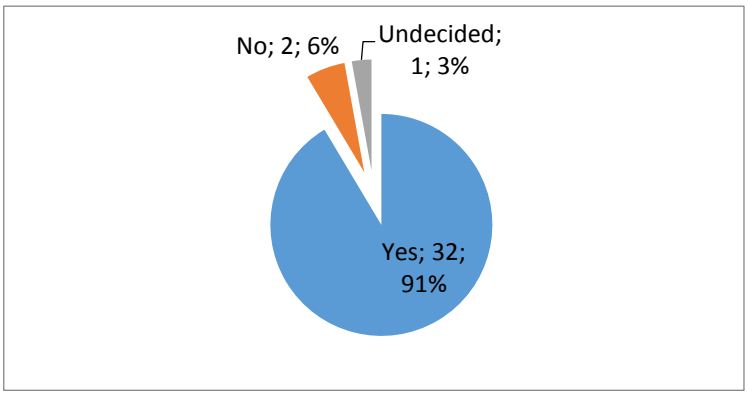
Therefore, It is statistically significant that domestic aplication of biofuel has increased in the last two years.

Question.2 Has the industrial application of biofuel increased in the last two years?

Table .7 Biofuel application (Question 2).

Categories	Number of Respondents (NR)	%
Yes	32	91.4
No	2	5.7
Undecided	1	2.9
Total	35	100.0

Figure.5 Pie Chart on biofuel application (Question2)



Chi-Square Test(Question 2)

Asymp.Sig.	,000

p-Value 0.000 since p<0.05

Therefore, it is statistically significant that the industrial application of biofuel has increased in the last two years.

In table 6 and 7, respondents agreed to the increase in Domestic and industrial application of biofuel within the last two years(2014 and 2015). Responses to both questions were significantly ($p<0.05$) as indicated below each table.

This increase has been driven by Nigerian Biofuel Policy and Incentives aimed at increasing the domestic and indutrial application of biofuel.[5]

The demand for Kike Green Cook Stove has increased in the last two years (2014 and 2015).Presently in Nigeria and some other African countries, there are sales of over 200,000 cooking stoves (KIKE GREEN COOK STOVE) in West Africa. This indicates that the bioenergy sector has improved but not yet at the top.

This cooking stove makes use of ethanol cooking gel, which is made through conversion of biomass into cellulosic ethanol using combination of thermal, charcoal and biochemical techniques.The primary feedstock used is sawdust, in which a yield of cellulose ethanol for each fiber was more than 200 liters. This technology was developed and registered with the Nigerian Patent Registry in the name of SME Funds. UNDP and Bank of Indus try (BOI) under the access to Renewable Energy Facility Project have endorsed Kike Green Cook Stove.[6]

The increase in biofuel application might be connected with the increase in biofuel use in Vehicles. The use of biofuel blends of 10-20 percents requires no engine modification. There is a technology called Flexi Fuel Vehicle (FFV) technology, which is well developed to allow access to gradual introduction of biofuel in any country. FFV cars can run up to 85% biofuel blend.[7]

[5] PeterKayode et al. The Nigerian Biofuel policy and Incentives (2007): A Need to follow the Brazilian Pathway. International Association for Energy Economics,2009,p.35-39

[6] Schultz LR. Scaling Renewable Ethanol For Clean Coking Fuels, 2014,[online].[cit.2016-03-25]. Internet source: http://www.gebiofuels.com

[7] Highina, B, Bugaje et al. Liquid Biofuels as Alternative Transport Fuels in Nigeria. Petroleum Technology Development Journal. Vol 1, ISSN 1595-9104 [online]. [cit.2017-03-24]. http://www.ptdjournal.com/2012/bk_highina_et_al_jan2012.pdf

Figure.6 Kike Green Cook Stove

Source: http://kikegreenstoves.org/

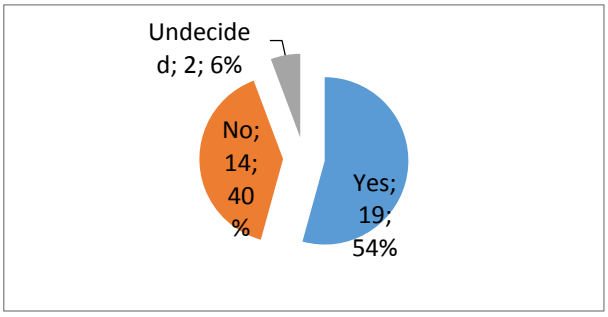
5.4.1. Land Use and Acquisition

Question.3 Fast conversion of arable land for feedstock cultivation?

Table.8 Land Use and Acquisition (Question 3).

Categories	Number of Respondents (NR)	%
Yes	19	54.3
No	14	40.0
Undecided	2	5.7
Total	35	100.0

Figure.7 Pie Chart on Land Use and Acquisition (Question 3).



Chi-Square Test (Question 3)

Asymp.Sig.	,384

p-Value 0.384 p>0.05

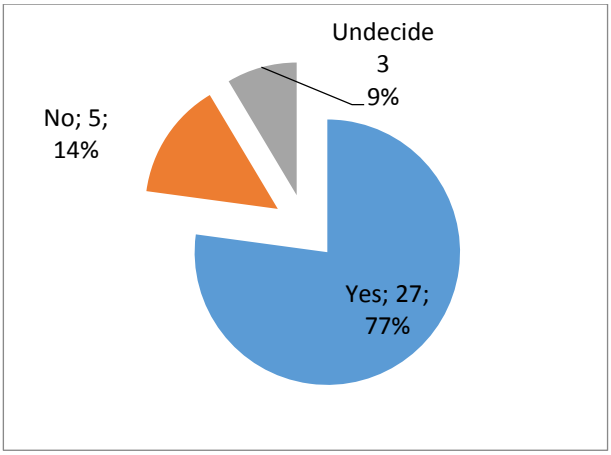
Therefore, it is not statistically significant that there is fast conversion of arable land for feedstock cultivation.

Question.4 Are more investors getting large areas of land for cultivation of biofuel feedstock?

Table.9 Land Use and Acquisition(Question 4).

Categories	Number of respondents(NR)	%
Yes	27	77.1
No	5	14.3
Undecided	3	8.6
Total	35	100.0

Figure.8 Pie Chart on Land Use and Acquisition (Question 4)



Chi-Square Test (Question 4)

Asymp.Sig.	,000

p-Value 0.000 p< 0.05

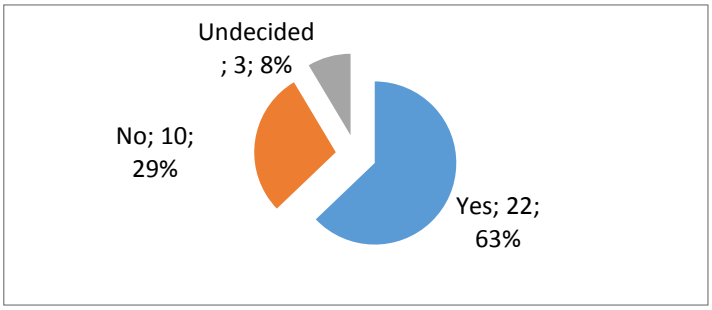
Therefore, it is statistically significant that more investors are getting large area of land for cultivation of biofuel feedstock.

Question.5 Do you think in future there will be a decline in the availability of land used for planting food crops needed for consumption as a result of feedstock production?

Table.10 Land Use and Acquisition (Question 5).

Categories	Number of respondents(NR)	%
Yes	22	62.9
No	10	28.6
Undecided	3	8.6
Total	35	100.0

Figure.9 Pie Chart on Land Use and Acquisition (Question 5)



Chi-Square Test (Question 5)

Asymp.Sig.	,034

p-Value 0.034 p<0.05

Therefore,it is statistically significant that in future there will be a decline in the availability of land used for planting food crops needed for consumption as a result of feedstock production?

In Table 8, despite more of the respondents agreeing that there is fast conversion of arable land for feedstock cultivation, it was not statistically significant (p>0.05). A similar study

carried out by Balogun and Salami (2015) also indicated that recently there is no fast conversion of arable land for feedstock cultivation.

This analysis showed that presently there is enough land for food production but perhaps in future rapid increase in feedstock cultivation as a result of increase in demand for biofuel might result into fast conversion of arable land for feedstock cultivation.

Nigeria is blessed with vast area of fertile land. Based on statistics, Nigeria has a total land area of 910,770km² and an arable land area of 300,736km².[8] However, there is need to put into consideration the effects of increased production of biofuel feedstock on arable land.

In Table 9, there was a strong agreement in perception with investors getting large areas of land for cultivation of biofuel feedstock with a significance of ($p<0.05$) while in Table 10, there was high agreement in perception with future decline in the availability of land used for planting food crops needed for consumption as a result of feedstock production with a significance ($p<0.05$).

This analysis revealed that more investors getting large areas of land for feedstock cultivation has not resulted into fast conversion of arable land for feedstock cultivation but in future there are possibilities if not checked.

It also revealed the issue of land grabbing by foreign investors. Observation showed that the surveyed locations used for this case study consist of large areas of land commonly referred to as “marginal land”. Potential investors in biofuel began to perceive the attractiveness and that it could be exploited for biofuel feedstock cultivation (Mercer, 2003). There are reports and evidences to ascertain the problem of large scale land acquisition by foreign investors in Africa. Recent findings by Global Development (2010) revealed that a million of Chinese farmers have encroached Africa and that there is buying and leasing of land in some African countries by the world’s richest countries in order to meet their insatiable desire for food and fuel.

Land prices in Africa compared to other places are “very cheap” thereby suggesting an attractiveness to foreign investors. Also cheap labour, cheap access to land , promising market and biofuel development are various reasons behind the “land grab” (Friends of the Earth Africa and Friends of Earth Europe, 2010).

[8] Land use statistics by country, [online]. Updated on 22.03.2017, [cit.2017-03-25].Source: https://en.wikipedia.org/wiki/Land_use_statistics_by_country

This land grab trend is mostly visible in developing countries such as Nigeria where there is high level of corruption, weak governance and enabling environment for investors interested in maximizing profit at the expense of social and environmental standards.

One of the implications of land grabbing in Nigeria is that it could lead to commercial conflict or clashes as a result of threats to the environment being perceived as a threat to individuals thus making the business environment unsafe for investors genuinely interested in boosting the biofuel industry in Nigeria.[9]

Other implications of land grabbing are unemployment generation, food insecurity, land tenure threats and endangered sovereignty and economic wellbeing of citizens.

Solutions to land grab problem are:

1. Nigerian Enivironmental safety standards must be fortified and the monetary value of the impact cost of the environmental effects of the project should be included into the land deals so taht communities bearing the environmental effects of such project can use the funds to excute projects that will reduce or prevent the environmental hazards immanent in such investment.

2. The land Use Act must be reformed in such away that allows the Indegenes who own the land to have a say in structuring the terms of leasing or land tenure that may involve foreign investors.

3. There is need to strengthen the anti- corruption campaign by making sure laws are been enforced to prevent corrupt officials from maneuvering laws to thier own satisfaction.

4. Government must ensure the availability of legal support to people whose lands might have ben grabbed and as well providing expert advice with regards to negotiation of contracts with interested biofuel investors.

As regards to the problem relating to the issue of future decline in the availablity of

land used for planting food crops needed for cosumption as a result of feedstock production owing to the fact that the availability of arable land is a determining factor, there is need to proffer a solution.

Land is issued for cultivation for food production, consumption and as well needed for bio-fuel production. As a result there is a competitive fight between food and fuel. Nigeria with a population of over 170 million people need a lot of food to feed its citizens and owing to this

[9] Onoja et al. Foreign Land Acquisition in Africa: Implications for Trade, Investment and Development Policies. P- 1-11, [online]. [cit.2017-03-25]. Internet source: http://new.trapca.org/wp-content/uploads/2016/04/TWP1114-Implications-of-large-scale-land-acquisitions-by-foreign-investors-for-Nigerian-Agricultural-Policy-reforms-and-Foreign-Investment-drive.pdf

fact, need a large portion of land mainly for food production so as to meet up with food demand.

Statistically, there is 785,000km² of agricultural land in Nigeria out of wish 48% consists of "permanent meadows and pastures". Nigeria actually has the capacity for improved efficiency based on its land area. As a result there are no, imminent risk arising from land usage in Nigeria. High food prices has the tendency of limiting the production of bio-fuels, since food markets may be more attractive options for farmers and as a result food issues in relation to bio-fuels production should not be neglected. Good access to land brings about a positive inter-connectivity between food production and bio-fuel energy investment.

The recommended solutions to avoid future decline in the availability of land used for planting food crops needed for consumption as a result of feedstock production are as follows:

1. Nigeria agricultural policy discouraging promotion of cash crops over food crops.

2. It must be ensured that land being leased for production of biofuel feedstock genrate at least 40% of the produced crops, which will be used in supplying food for Nigerian economy thereby preventing food insecurity.This achievable by creating a policy with an enforcing units.

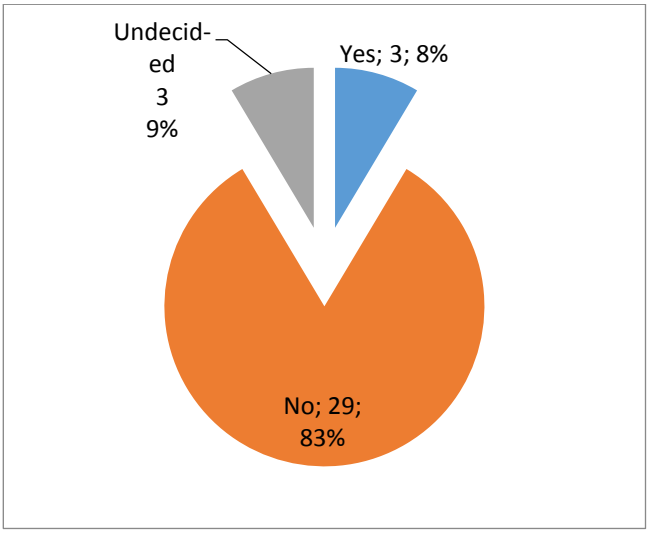
5.4.2 Biophysical environmental impact of biofuel utilisation

Question.6 Biofuel production activities have caused environmental pollution?

Table.11 Biophysical environmental impact of biofuel utilisation (Question 6).

Categories	Number of respondents(NR)	%
Yes	3	8.6
No	29	82.9
Undecided	3	8.6
Total	35	100.0

Figure.10 Pie Chart on Biophysical environmental impact of biofuel utilisation (Question 6).



Chi-Square Test for (Question 6)

Asymp.Sig.	,000

P-Value 0.000 p<0.05

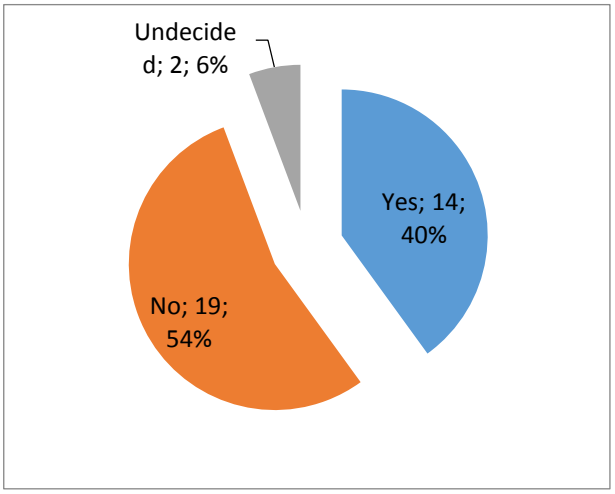
Therefore it is statistically significant that biofuel production activities have not caused environmental pollution.

Question.7 Irrigation used for feedstock cultivation is affecting water availability?

Table.12 Biophysical Environmental impact of biofuel utilisation (Question 7).

Categories	Number of respondents(NR)	%
Yes	**14**	**40**
No	**19**	**54.3**
Undecided	**2**	**5,7**
Total	**35**	**100.0**

Figure .11. Pie Chart on Biophysical environmental impact of biofuel utlisation (Question 7)



Chi-Square Test (Question 7)

Asymp.Sig.	,384	P-Value 0.384	p>0.05

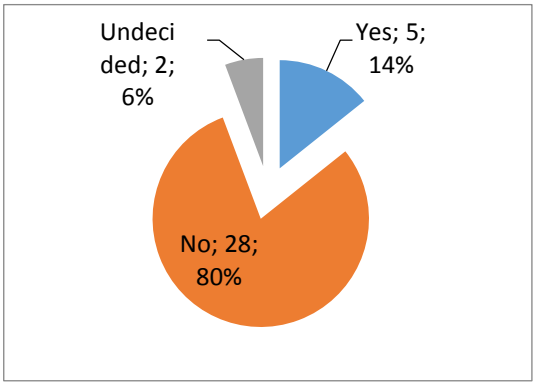
Therefore, it is not statistically significant that irrigation used for feedstock is not affecting water availability.

Question.8 Are plants used for producing biofuel reducing soil nutrients on land?

Table.13 Biophysical environmental impact of biofuel utilisation (Question 8).

Categories	Number of respondents(NR)	%
Yes	**5**	**14.3**
No	**28**	**80.0**
Undecided	**2**	**5.7**
Total	**35**	**100.0**

Figure. 12. Pie Chart on Biophysical environmental impact of biofuel utilisation (Question 8)



Chi-Square Test (Question 8)

Asymp.Sig.	,000

p-Value 0.000 p<0.05

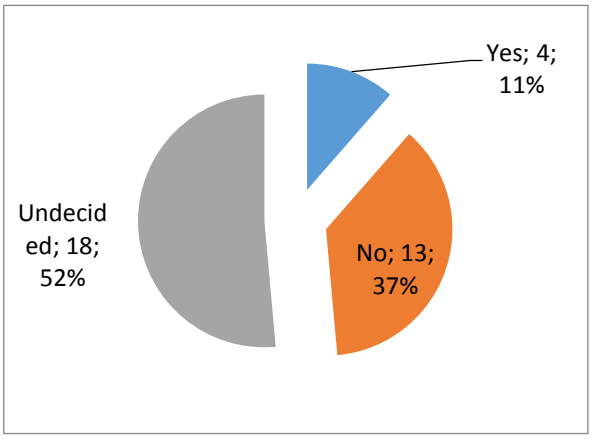
Therefore, it is statistically significant that plants used for producing biofuel is not affecting soil nutrients.

Question.9 Are farmers well orientated about cropping culture?

Table.14 Biophysical environmental impact of biofuel utilisation (Question 9)

Categories	Number of respondents(NR)	%
Yes	**4**	**11.4**
No	**13**	**37.1**
Undecided	**18**	**51.4**
Total	**35**	**100.0**

Figure.13 Pie Chart on Biophysical enviromental Impact of biofuel utilisation (Question 9)



Chi-Square Test (Quetion 9)

Asymp.Sig.	,029

p-Value 0.029 P<0.05

Therefore it is statistically significant that farmers are not well orientated about cropping culture.

In Table 11, regarding biofuel production activities causing environmental pollution,although debatable, there was a strong disagreement that biofuel production acitivities have caused environmental pollution with a significance of ($p<0.05$). This is due to the fact that biofuel is a green/clean energy for power generation. Bioenergy crops can reduce or offset green house gas emissions by directly removing Co_2 from air and storing it in crop biomass and soil. The kind of land-use system adopted might have contributed to biofuel production activities not resulting into environmental pollution (Fargione et al. , 2008; The Royal Society, 2008; Searchinger, 2008).

In Table 12, the situation as regards availability of water being affected by irrigation used for feedstock cultivation was not very clear with 40% of the respondents agreeing and 54.3% of the respondents disagreeing. A further test for level of significance using Chi-Square showed a significance level ($p>0.05$), suggesting that irrigation used for feedstock cultivation is affecting water availability.

Water is an important ingredient needed for bio-fuel production. This is an important area which must be put into consideration. Large scales bio-fuel program need a non- water stress area.**Chyba! Záložka není definována.**

Based on estimation, 6.0 billion tons of water is required for cultivating cassava in order to produce ethanol substituting 5% of Nigeria's gasoline consumption which is about 3% of Nigerian water resources.[10]

Adequate rainfall is needed for sufficient water. Scarcity of water is common in certain regions in Nigeria, especially the northern part.

Production of biofuel is believed to consume high quantity of water than fossil fuels (Mishra and Yeh, 2011; King and Webber, 2008), which leads to large stresses on availability of water and quality as aresult of salinization and pollution from agricultural activities (Shah et al., 2000). An increased biofuel development will have similar effect on water sources as that of agriculture since agriculture has been regarded to be the biggest user of global fresh water supply (Singh et al., 2010). About 70 percent of fresh water is used for agricultural purposes (Comprehensive Assesment of Water Management in Agriculture, 2007).

As a result of increased competition with domestic or industrial use , water resources are increasingly becoming scarce. Climate change interms of reduced rainfall in some key producing regions will exert more pressure on already scarce resources. Biofuel currently

[10]Adeoti O. Water use impact of ethanol as a gasoline substitution ratio of 5% from cassava in Nigeria. Biomass Bio-energy 2010:34(7):985-92

account for about 100km³ (or 1 percent) of all water transpired by crops worldwide, and about 44km³ of all irrigation water withdrawals (de Fraiture, Giordano and Yongsong, 2007).

At commercial yield levels, many of the crops presently used for biofuel production such as sugarcane, oilpalm and maize have relatively high water requirements and as a result need to be cultivated in a high-rainfall tropical area, unless it is been irrigated. The processing of feedstocks into biofuel require large quantity of water during washing of plants, seeds and cooling by evaporation. Production of biofuel will have impact on local water resource balance.[11]

The effect of irrigation used for feedstock cultivation on water availability also depends on organisational choices and technology adopted.

Table.15 Water requirements for biofuel crops.

Crop	Annual obtainab-le fuel yield(Litres/ha)	Energ-y yield(GJ/ha)	Evapotranspi-ration Equivalent (Litres/litre fuel)	Potential Crop evapo-transpiratio-n (mm/ha)	Rainfed evapo-transpiratio-n (mm/ha)	Irrigated crop water requirement	
						(mm/ha)[1]	(Litres/Litre fuel)
Sugar cane	6000	120	2000	1400	1000	800	1333
Maize	3500	70	1357	550	400	300	857
Oil palm	5500	193	2364	1500	1300	0	0
Rapes-eed	1200	42	3333	500	400	0	0

[1] On the assumption of 50 percent irrigation efficiency.

Source: FAO

Solution to the problem of inavailablity of water as a result of irrigation used for feedstock cultivation is adopting a good water resource management.

Water resource management involves planning, developing , distributing and managing the optimum use of water resources. The essence of water resource management is to allocate water on a justifiable basis s a result of competing demands for water inorder to satisfy all uses and demands. There is need for specific knowledge of the available resources , usage,

[11] How will biofuel production affect water, soil and biodiversity?p.63-65.[online]. Internet source: www.greenfacts.org/en/biofuels

competing demands for the resources and operating system to tranlate policy decision into visible actions.

Water resources can be properly managed by:

a) Having knowledge about the amount of water required for biofuel crops so as to avoid wastage and enhance conservation. Using the methodology for estimating water

footprint by (Mekonnen and Hoekstra, 2010) amount of water required by biofuel crops could be determined.

The first procedure is to determine the evapotranspiration (ET in mm per day) crop water requirements (m^3/tons) indicated in the formula:

$CWR = ET/Y$…….. (1)

Where CWR is water requirement (m^3) for producing a ton of bio-fuels crops,

ET is the seasonal evapotranspiration of surface water (m^3/km^2) for the crop production period,

Y is the crop yield (kg/m^2).

Based on Yang et al, formula for estimating water footprint is as follows:

$WF_b = \rho * C * CWR$ ……..(2)

Where WF_b denotes the water footprint given in m^3/L,

ρ represents density of specific bio-fuels (Kg/L) with different fuel types.

The density for bio-fuels is 0.789kg/L for ethanol and 0.88kg/L for diesel

C represents: the feedstock for bio- fuels conversion ratio (L/tons) Alptekin and Canakci, 2008.

b) Secondly, water can be properly managed admistratively by adopting a systém where by agricultural spray irrigation abstraction is been restricted or stopped during drought by Evironmental Agency. This act simply implies that Evironment Agency is trying to create a voluntary reduction in water use where ever possible.

Administratively, licence should be issued to anyone who wants to abstarct water. This simply implies that people should apply for a licence and the licence should be granted based on the level of availablity of waterat that location. If the level of water available is low, then the licence should not be issued. This calls for a rerform of water governance in Nigeria.

c). Recyclying of water: Making water reuseable is an option that should not be overlooked. This can be achieved by using water treatment plant to purify the water. Recycled water if well treated by ensuring water quality required for use will go a long way to satiisfy water demands.

d) Reduction of water losses through maintenance helps to conserve water.

e) Engaging in a system called water transfer, which involves an artificial movement of water from water body to another. This involves the transfer of three basic components namely source, a vector and a receptor. The source basically a river, lake, a reservoir or ground water. Vector may be an artificially constructed channel, a pipeline, an aqueduct a rail tanker, or existing river channel. The receptor may be a water supply system, a reservoir or direct abstraction for irrigation.

Basically water tranfers can be effective means of providing water for feedstock cultivation and public water supply esspecially where water is scarce.

f) Improved knowledge about water availabilty in a region in what is called “Improved Forecasting” allows a more dynamic allocation of water as well as allowing farmers to plan cropping patterns and water application. This is achievable by having well equipped hydrological forecasting stations with trained workers.[12]

In Table 13, concerning the issue of plants used for producing biofuel reducing soil nutrients on land, there was a strong disagreement that plants used for producing biofuel is reducing soil nutrients with a significance of ($p<0.05$).

In Table 14, few concrete results were obtained owing to the fact that most of the respondents did not decide. 11.4% of the respondents agreed to the fact that farmers are well orientated about cropping culture, while 37.1% of the respondents disagreed. Chi-Square test for level of significance produced a significance level of ($p<0.05$), indicating that farmers are not well orientated about cropping culture. Owing to the fact that cropping culture is an important issue in farming, there is need for farmers to be enlightened about cropping culture.

Cropping culture simple means the use of appropriate cultivation practices in order to prevent soil erosion, increase soil organic matter and reduce greenhouse gas emissions.

Land-use change coupled with increased agricultural production on existing croplands can have a negative impact on soils.

[12] Global Food Security. Agriculture’s Impacts on Water availability.[online].Internet source: http://www.foodsecurity.ac.uk/assets/pdfs/farming-availability-water-report.pdf

Farmers need to be enlightened on organic waste recycling and soil fertility management through the help various agricultural agencies by providing mandatory training orientation courses on cropping culture (production technologies and techniques) with government providing funds to facilitate such programs.

Conservation tillage, crop rotations and other agricultural management practices if administered properly can reduce negative effects and enhance environmental quality along with increased biofuel production.

Growing of perennials such as oil palm, sugarcane instead of annual crops will improve soil quality by increasing soil cover and organic carbon levels.

Reduction in chemicals such as pesticides and fertilizers will create an eco-balance thus creating a positive impact on biodiversity.[11]

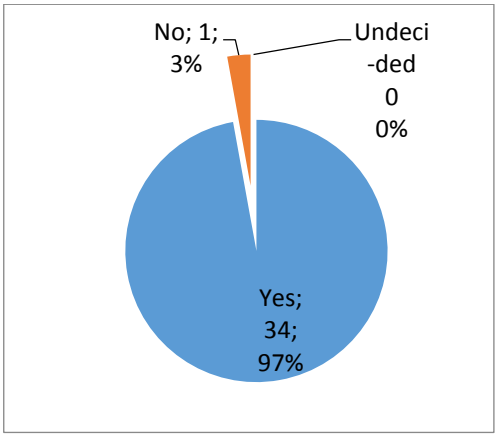
5.4.3 Economic impact of biofuel

Question.10 Do you think the adoption of biofuel will reduce the level of unemployment in Nigeria?

Table.16 Economic Impact of biofuel (Question 10)

Categories	Number of respondents(NR)	%
Yes	34	97.1
No	1	2.9
Undecided	0	0.0
Total	35	100.0

Figure.14 Pie Chart on economic impact of biofuel (Question 10)



Chi-Square Test (Question 10)

Asymp.Sig.	,000

p-Value 0.000 p<0.05

Therefore it is statistically significant that adoption of biofuel will reduce unemployment in Nigeria.

In Table 16, there was a strong agreement that the adoption of biofuel will reduce unemployment in Nigeria with a significance level of (p<0.05), hence the need for diversification.

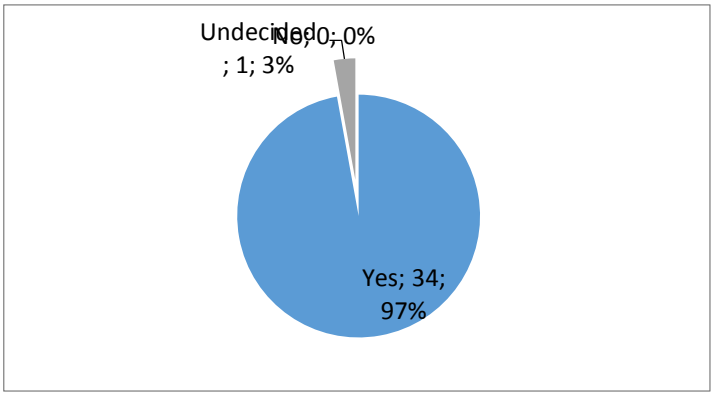
5.4.4 Biofuel policy

Question .11 Do you think biofuel policy has been beneficial to Nigeria in the area of food security, job creation , environmental protection, provision of energy and water conservation?

Table.17 Biofuel Policy (Question 11)

Categories	Number of respondents(NR)	%
Yes	**34**	**97.1**
No	**0**	**0**
Undecided	**1**	**2.9**
Total	**35**	**100.0**

Figure.15 Pie Chart on Biofuel Policy (Question 11)



Chi-Square Test (Question 11)

Asymp.Sig.	,000

p-Value 0.000 p<0.05

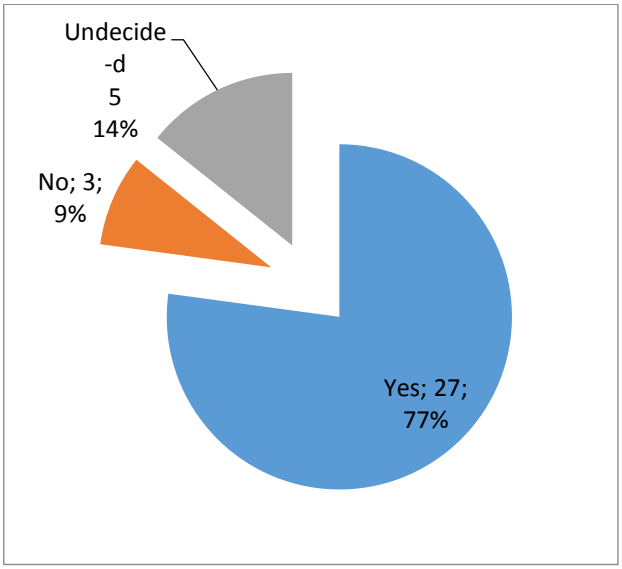
Therefore it is statistically significant that the biofuel policy has been beneficial to Nigeria in the area of food security, job creation , environmental protection, provision of energy and water conservation.

Question.12 Biofuel companies having access to to financial assistance in purchasing biofuel producing engines?

Table.18 Biofuel Policy (Question 12)

Categories	Number of respondents(NR)	%
Yes	27	77.1
No	3	8.6
Undecided	5	14.3
Total	35	100.0

Figure.16 Pie Chart on Biofuel Policy (Question 12)



Chi-Square Test (Question 12)

Asymp.Sig.	,000

p-Value 0.000 p<0.05

This implies that it is statistically significant that biofuel companies having access to financial assistance in purchasing biofuel producing engines.

In Table 17, there was a strong agreement to Nigeria's biofuel policy been beneficial to Nigeria in the area of of food security, job creation, environmental protection, provision of energy and water conservation with significance level of (p<0.05).However, there is need for constant review for optimal benefits.

In Table 18, it was statistically significant that biofuel companies are having access to financial assistance in purchasing biofuel producing engines with significance of (p<0.05). The result showed that the Nigerian biofuel policy has been beneficial in terms of rendering financial assistance.

As stipulated in Nigerian Biofuel Policy and Incentives 2007, long term preferential loans will be made available to biofuel companies by the Central Bank of Nigeria (CBN) through commercial banks and agricultural banks. These loans are basically aided through the provision of special low interest loans, which are provided by the Bank of Industry, Nigeria Export Import Bank, commercial banks, Agricultural banks and other development finance agencies.

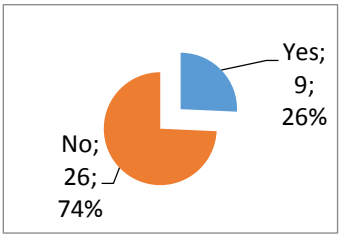
5.4.5 Food security

Question.13. Are there scarcity of food crops for consumption as a result of biofuel feedstock cultivation?

Table.19 Food security (Question 13)

Categories	Number of respondents(NR)	%
Yes	9	25.7
No	26	74.3
Undecided	0	0.0
Total	35	100.0

Figure.17 Pie Chart on Food Security (Question 13)



Chi-Square Test (Question 13)

Asymp.Sig.	004

P-Value 0.004 p<0.05

This implies there is no scarcity of food crops for consumption as a result of biofuel feedstock cultivation.

In Table 19, a generally high degree of disagreement was recorded that there are scarcity of food crops for consumption as a result of biofuel feedstock cultivation.

Responses showed a significant ($p<0.05$) difference in perception, stating that biofuel feedstock cultivation has not resulted into scarcity of food crops for consumption.

Recently, Nigeria experienced scarcity of food crops, but this analysis showed that there were other factors that could have been responsible. Respondents showed believe in the ability of farmers to meet up with the need for biofuel feedstock and also provide for consumption.

There has always been argument that if food crops are diverted for biofuel production, it could lead to scarcity of food. Nigeria is blessed with vast majority of fertile lands and as such the danger of insufficient food provisioning isn't imminent. According to Gressel, 2008, he explained that though there has been anxiety over the negative impact of biofuel on agricultural land, water, food supply and increase in food prices, that this could be attributed to some other factors apart from biofuel due to the fact that there are lot of fertile land for farming.

The effect of the demand for biofuel feedstock can be determined by the share effect on commodity and food prices in various localities (Agboola et al. 2011).

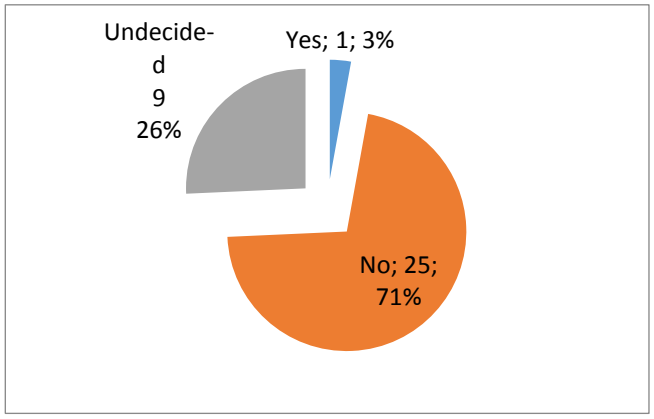
5.4.6 Technical Competence

Question.14 Do you think Nigeria has enough technical know-how on biofuel production?

Table.20 Technical competence (Question 14).

Categories	Number of respondents(NR)	%
Yes	1	2.9
No	25	71.4
Undecided	9	25.7
Total	35	100.0

Figure.18 Pie Chart on Technical Competence (Question 14)



Chi- Square Test (Question 14)

Asymp.Sig.	,000

p-Value 0.000 p<0.05

Therefore, it is statistically significant that Nigeria does not have have enough technical know on biofuel production.

In Table 20, respondents showed a high level of disagreement on Nigeria having enough technical know-how on biofuel production. 71% of the respondents disagreed, while 3% of the respondents agreed. Using Chi-Square test, a significant level of ($p<0.05$) was obtained, which indicated that there is need for improvement on Nigeria's technical know-how on biofuel production.

Although the potentials are there, there is need for development. There is need for practical approach towards improving on technical know –how in biofuel production.

These are achievable by:

1. Private and public stakeholders need to have a collaboration/partnership development initiative with foreign Investors. This is achievable by either visiting or inviting each other.

2. Research and Developments: Governments should support research and development projects. By supporting research programs, production cost could be reduced considerably.

2. Research and Developments: Governments should support research and development projects. By supporting research programs, production cost could be reduced considerably.

The research and development should focus on the following:

a) Making a case for biofuel and considering the influence which development in science and engineering will have on biofuel.

b) Assessing the capability of scientific developments to contribute to greater and more efficient production of biofuel.

c) Reviewing international policies, science and industrial experience.[13]

3. Incentive and grants: Government should grant incentives and loans to people so as to embark on seminars and training workshop in order to obtain fresh innovative ideas.

4. Developing production and distribution of biofuel. This is achievable by forming specific groups that will consider biofuel opportunities present in rural development programs and also increasing surveillance to prevent discrimination against biofuel.

[13] Akande, S.O, Olorunfei,F.B. Nigerian Institute of Social and Economic Research . Research and Development potentials in Biofuel. ISSN 270-0053. Pp.34-45. [online]. [cit.2017-03-27].source: https://www.ajol.info/index.php/afrrev/article/viewFile/47512

6.0. CONCLUSION AND LIMITATIONS

Analysing data obtained from the questionnaire gave the opportunity to pinpoint major problems affecting biofuel utilisation in Nigeria. If the solutions proffered in this thesis are been applied, then there is tendency for Nigeria to be a global giant in the biofuel industry.

Nigeria has the potentials of fully embarking on renewable sustainable energy program. It has cogent reasons to diversify its economy, supply of fuels and proper utilization of its natural resources for an economic growth.

In order to prevent health issues arising from the use of fossil fuels, I would suggest that Nigeria should fully embrace the utilization of bio-fuels so as to create a safe environment thereby preventing sickness such as cancer which in turns reduces the mortality rate. Biogas production would be a means of reducing health related issues from pollution. Nigeria needs to enlighten its citizens about the utilization of bio-fuel as a replacement for fossil fuel.

Limitations of the research

There were certain limitations during the course of the research. Firstly, the roads leading to areas needed for survey were not accessible. Secondly, many respondents thought their data would be given to government for tax verification. Thirdly, some of them see the researcher as a competitive person that wants to know more about their business and thereby dominate their business.

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