AN EVALUATION OF THE IMPACT OF CLIMATE VARIABILITY ON PINEAPPLE PRODUCTION IN EDO STATE AND ITS MARKETABILITY IN LAGOS

By

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ABSTRACT

Pineapple is the world's most popular non-citrus tropical and subtropical fruit and until recently, about 80% of pineapple produced in Nigeria came from small scale farms and its production had been under mixed cropping systems. The various localities involved in the pineapple production are now known to be exposed to climate related uncertainties across an integrated chain, including pineapple cultivation, harvesting, storage and marketing. In recent years, access to international markets enhanced local values of fresh fruits and increased interest in the cultivation of pineapple in Nigeria, especially, in Edo State. This has encouraged the development of local processing industries and large scale intensive managed farms where pineapple is produced as a monocrop.

In 1999, the World Bank, through her agency (FAO) rated Nigeria as the 6th largest producer of pineapple. Unfortunately, today, we observe that the production of pineapple is on the decline both in size, quality and quantity. This paper therefore investigates into some climatic elements such as temperature, rainfall, etc. in Edo State of Nigeria to see the variation in the last 10 years. It is concluded that the efficiency of microclimate manipulation depends significantly on the level of land cultivation of a particular farm, as well as the doses of mineral fertilizers. Observation also shows that optimization of water regime of the soil can raise pineapple yields.

Twenty (20) pineapple farmers from the Edo State Ministry of Agriculture were interviewed, and in Ketu Food Market, Lagos, we administered 60 questionnaires to 60 dealers in Edo pineapple.

Using descriptive statistic and time series analysis, the study shows that some climatic variables influence the quality and quantity of the fruit during production and while in transit to Lagos.

INTRODUCTION

The impact of weather on Pineapple progress, condition and ultimately, production and price, is not common in literature. For example, timely rainfall and seasonal temperatures can significantly enhance crop production. In contrast, untimely precipitation and temperature extremes can significantly reduce pineapple production. Although, excessive heat and dryness can stress the fruits throughout much of the growth cycle, the timing of these events can result in significant yield and production realizations.

The climate of Nigeria is basically tropical in the South and Savannah in the North. Two main seasons constitute the climate; which are the rainy and dry seasons. The main ecological zones are the tropical rain forest along the coast, savannah in the middle belt and semi arid zones in the northern fringes. Climate change is already altering boundaries of these major ecological zones, animal and plant composition, salt water intrusion along the coast, erosion and flooding in the south, drought and desertification in the marginal arid zones of the country.

Pineapple industries worldwide are exposed to climate related uncertainties across an integrated chain of industrial sectors, including pineapple cultivation, harvesting and marketing. There are feasible management options, such as introducing irrigation systems to mitigate some of the adverse impacts of climate variability.

The study Area

This case study was carried out in Ketu Market in Kosofe LGA in Lagos Metropolis. The origin of the commodity in question is from Ovia Local Government Areas in Edo State. The commodity is pineapple. It is given consideration based on its perishability and quick response to climate change. Lagos has grown demographically, spatially and particularly in a real extent. The population of the city keeps rising as a result of rural urban migration and natural increases. The city engulfs Ogun State through Badagry Road, Agege Motor Road and Ikorodu-Ibadan Road. The population of urban Lagos is currently more than 8million which qualifies it as a mega-city. Urban population as a percentage of the national population in 1970 was 20%. This rose to 38% in 1993 and the projected proportion is estimated at 60% at the end of 2010 (Oni, 2004). The rate of urban population growth far exceeds the national growth rate of 3%. This rapid growth is largely responsible for the quick consumption of commodities from the hinterland. This paper therefore investigates into some climatic elements such as temperature,

rainfall, etc and the movement of pineapple from Edo State of Nigeria to see the variation in the last 10 years. Figure 1 shows the origin of the products in Edo State and the market in Lagos.

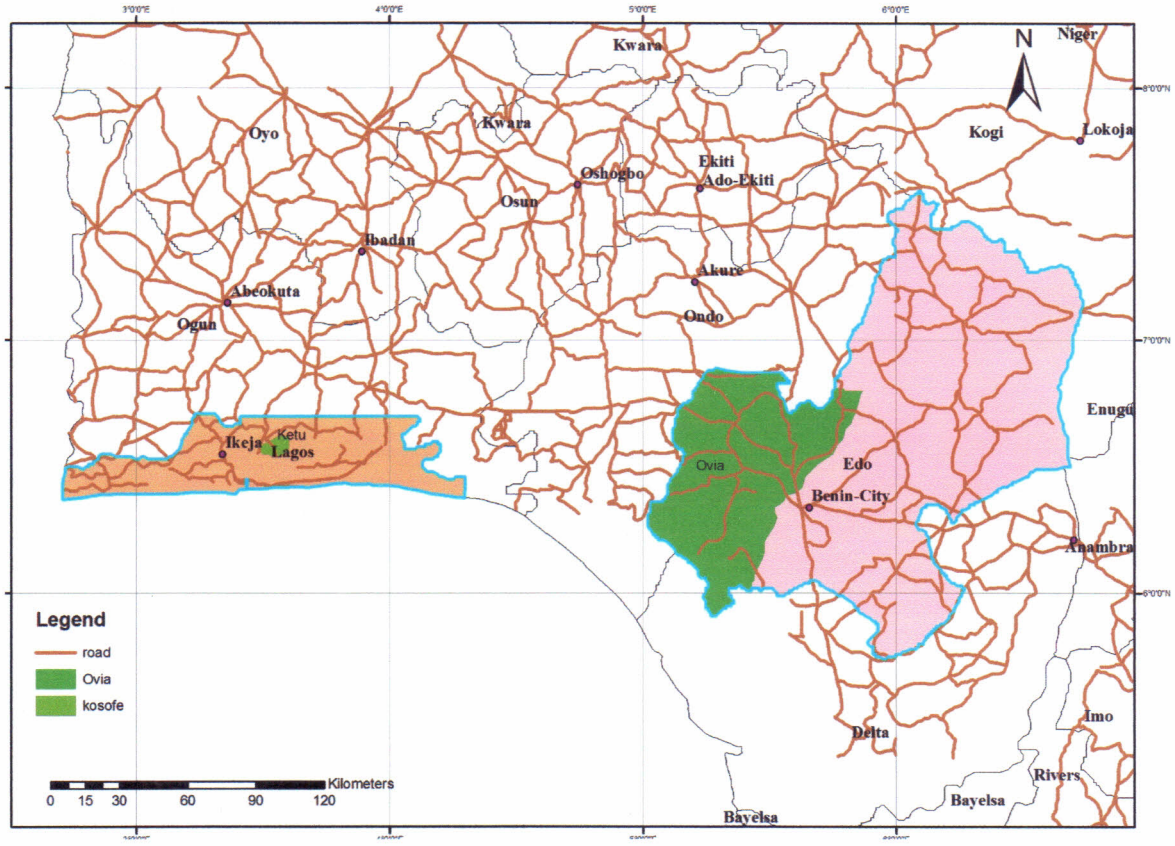

Fig. 1: Origin and Market for the Pineapples in Nigeria.

The Statement of Problem

Pineapple is the world's most popular non-citrus tropical and subtropical fruit. Until recently, about 80% of pineapple produced in Nigeria came from small scale farms managed under mixed cropping systems. Recent access to international markets enhanced local values of fresh fruits, resuscitation of pineapple cultivation especially in Edo State. This has encouraged the development of local processing industries and large scale intensive managed farms where pineapple is produced as a monocrop. Pineapple as an economic crop has encouraging potentials in increasing the income of farmers who are involved in its production and those involved in its marketability. Current production figures show that Nigeria is the 6th largest producer of pineapple in the world and if current production and marketing trends are encouraged,

commercial production for export and local consumption will be enhanced (FAO/World bank, 1999).

Pineapple is one of the most important agricultural crops in Edo state. As it is partially rain fed, climate variability has a major impact not only on pineapple production but also on the income of the peasant farmers in the state. Therefore, it is essential to understand the impact of major changes in climate patterns that affect pineapple and pineapple yield.

In recent times, consumption of pre-cut fruits, including pineapples, has increased considerably because of the convenience offered to consumers by these fresh-cut products. Harvested pineapples from Edo State are moved to Lagos market by road. The road condition on this axis is so pathetic that an average lorry (911) would take about 15hours and in some occasions 3 days(especially during the rainy season) to move from Edo State to Lagos market. These delays in transit have some impacts on the fruit. In recent times, the marketers observed that ten years ago, even when they had delays on the way to Lagos market, the volume of wastes was not as much as what is available today. In those days, in a 911 truck, with nine coaches, the maximum waste was about a dozen pineapples. Today, the waste has increased to about three dozens in a 911 truck with nine coaches. Consequently, this study was structured to investigate the increasing volume of wastes in pineapples brought to Lagos market from Edo State and also to ascertain the decreasing size of the pineapples in the last ten years, whether there is a relationship between climate change and the variables mentioned above.

The objectives guiding the inquiry were to:

1. evaluate the time and cumulative effects of weather throughout the various stages of pineapple development
2. investigate whether the farmers and traders understand what climate change is.
3. determine the volume of wastes from an estimated volume that get to Ketu market.
4. investigate on the sizes of the pineapples brought to the market in the last ten years.
5. evaluate whether there is increase in the type called 'kpako' which is a hard specie which is usually not good for consumption, rather it is only used for treating malaria disease.

Methodology

Time-series analyses were used to diagnose the time and cumulative effects of weather throughout the various stages of pineapple development. Analogue comparisons are used often to identify similarities among recent and historical weather data. These analyses enabled us to estimate the likely impact of weather on current crop production based on comparable data from those years when similar weather patterns were observed. Ovia Local Government Areas(both North and East) in Edo State were purposely selected because there is high concentration of pineapple growers in these two local government areas.

Ketu market in Lagos Metropolis was selected because more than 80% of the pineapple that come from Edo State are off loaded in this market. From a list of pineapple growers from the Ministry of Agriculture in Edo State, we spoke to 20 farmers and in Ketu Market we administered questionnaire to 60 dealers in Edo pineapple.

An interview schedule with items based on the objectives of the study was used to collect data from the selected farmers and traders. The interview schedule contained 12 questions measuring

- demographic characteristics
- information on climate change
- information on observable changes in the last ten years
- information on wastes

The scope of this study was designed to look at the impact of seasonal variability on the size of pineapple in Edo State over a period of ten years and the problems of delays in transporting the product to Lagos market.

Measurement of Variables

Farmers' were asked to indicate their age, sex, educational attainment, marital status, years of farming, marketing outlet.

Traders were also asked to indicate their age, sex, educational attainment, marital status, years of marketing, marketing location and from where their product come from.

Information on climate change: farmers were asked to indicate whether or not they are aware of climate change and its impact on their crop.

Information on observable changes in the last ten years: farmers were asked to indicate the observable changes they have noticed on their crop in the last ten years.

Information on climate change: Traders were asked to indicate whether or not they are aware of climate change and its impact on their product.

Information on observable changes in the last ten years: Traders were asked to indicate the observable changes they have noticed on their product in the last ten years.

Information on wastes: Traders were asked to evaluate the rate of waste from a trip of 911 truck load of pineapple with 9 coaches in the last 10years.

RISK AND PINEAPPLE MARKETING SYSTEM

The pineapple production – from producer to final consumer – is subject to a wide range of risks and uncertainties. Economic and social benefits can be realized by minimizing the impacts of these risks. Risk in agriculture can be broadly defined into several categories (USDA, 2006).

Yield risk is probably the most commonly considered risk in agriculture, because it reflects directly the impact of weather on farm operations. Temperature and moisture variations are the typical causes of yield risk, with irrigation being one of the only significant approaches to minimizing the impact of hot or dry conditions.

Production risk entails all the factors that affect yield risk, plus the additional impact that adverse weather may have on producers ability to plant.

Price volatility is another important source of risk. Commodity price information is critical to producers, buyers and sellers up and down the supply chain. Agricultural commodity prices are subject to sharp fluctuations over relatively short periods of time and over a wide geographical range, depending on both local and global supply and demand conditions. Adverse or favourable agrometeorological conditions in one part of the world can lead to uncertainty and price risk in distant markets.

Income risk is caused by the three types of risk previously described, plus additional factors, including variation in the price and availability of the inputs required for production. For example, if a particular variety of pineapple is grown in Edo state and consumers in Lagos prefer that type of fruit, then availability and price of the fruit will have an impact on the incomes of Lagos state's pineapple consumers.

Conceptual framework:

Just-in-time concept (JIT)

Just-in-time concept originated as a new approach to manufacturing and has been successfully applied in many industries such as the automotive industry. It has significant implications for distribution and logistics. The overall concept of JIT is to provide a production system that eliminates all activities that neither add value to the final product nor allow for the continuous flow of material – in simple terms, that eliminates the costly and wasteful elements within a production process. According to Rushton et al (2005), the objectives of JIT are vitally linked to distribution and logistics, which include:

- the production of goods the customer wants;
- the production of goods when the customer wants them;
- the production of perfect quality goods; and
- the elimination of waste (labour, inventory, movement, space etc)

A critical evaluation of just-in-time concept shows that it is a management philosophy which aims at reducing waste and redundant inventory by delivering products, components or materials just when they are needed. This can be linked with the pineapple transportation from Ovia Local Government in Edo state to Lagos market. The case of JIT is far from being applied because of certain fundamental problems such as bad road, armed robbery, poor maintenance of vehicles, etc.

Results

OBSERVATIONS

1. The combination of heat and dryness occurred during the highly weather-sensitive tasselling and silking period of pineapple significantly reduces yield prospects.
2. Lower yield reduces production for each producer, potentially putting each producer's income at risk.
3. Risk and uncertainty affected every aspect of the pineapple commodity marketing system, from producer to final consumer. Weather-related yield and price risk translated into income risk in pineapple markets around Edo and Lagos states.

Table 1 shows rainfall distribution of Benin from 2000 to 2010 and Table 2 shows the mean annual rainfall and the maximum annual rainfall. The annual totals show rising and falling of rainfall volume. From 2000, the annual volume was on the increase until 2002 and dropped in 2003. In 2004, the volume rose to 194.00cm. it can be seen that the total volume has been oscillating. Generally, there is a consistent increase on the mean annual rainfall from 2000 to 2010 but however there are inter annual variation within the years. This actually would affect the yield and the sizes of the yield.

Table 1: Rainfall distribution of Benin (2000 -2010)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2000	4.0	73.0	60.8	170.0	192.0	413.7	294.7	237.9	345.0	351.4	49.0	48.7

2001	18.8	10.1	119.3	394.3	398.1	364.3	216.0	137.4	357.1	183.0	82.6	3.9
2002	0.0	115.3	163.5	278.1	199.4	344.9	411.3	491.8	294.8	149.5	101.0	9.9
2003	33.9	13.7	172.0	169.8	227.1	187.6	177.1	142.1	398.3	338.1	57.3	26.3
2004	28.8	28.3	68.4	118.9	250.7	448.9	288.0	403.0	297.6	299.8	94.3	1.6
2005	0	9.8	182.2	119.6	95.5	450.2	458.8	97	207.6	333.2	40	20.1
2006	34.1	22.3	146	117.1	394	240.2	462.4	359.4	334.4	217.6	32	0
2007	0	126.2	91.6	183.5	350.3	374.4	317.4	301	453.8	263.5	167.6	18.5
2008	10.3	8.8	146	204.5	202.9	272.9	414.6	319.7	745.8	241.9	95.4	7.2
2009	14.6	124.6	69.8	151.8	330.5	170.8	192.2	239	281.3	342.9	161	23
2010	0	99.8	55.3	321.1	158.4	212.6	199.6	532.9	608.7	267.4	306.5	49.2

Table 2: Mean Annual Rainfall and Maximum Annual Rainfall

Year	Mean Annual Rainfall (mm)	Max. Annual Rainfall (mm)
2000	186.7	186.7
2001	190.4	190.4
2002	213.3	213.3
2003	161.9	161.9
2004	194.0	194.0
2005	167.8	167.8
2006	196.6	196.6
2007	220.7	220.7
2008	222.5	222.5
2009	175.1	175.1
2010	234.3	234.3

Table 3 shows the temperature distribution of Benin. The record indicates that months of February and March have high temperatures while the month of August has the least in 2000 and 2001. It has to be noted that temperature is not a major limiting factor in the production of pineapple.

Table 3: Temperature distribution (Benin)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

2000	33.3	34.6	34.8	33.4	32.2	30.3	29.0	27.9	29.1	30.3	32.7	33.1
2001	32.8	34.8	34.0	32.2	31.7	30.3	28.8	27.8	28.8	31.2	32.7	33.5
2002	33.7	34.6	33.1	32.3	31.6	30.3	29.3	28.1	29.4	30.0	32.2	33.3
2003	33.3	35.2	34.1	32.8	32.3	30.1	29.5	29.1	29.0	30.5	32.1	33.2
2004	33.0	35.0	36.0	32.0	31.0	30.0	29.0	29.0	30.0	31.0	32.0	33.0
2005	33.2	34.7	35.1	33.1	31.2	30.6	29.2	28.8	29.5	31.1	32.8	33.5
2006	33.4	34.4	34.1	34.1	31.4	31.2	29.3	28.5	29.0	31.2	33.6	34.2
2007	33.2	35.1	34.1	33.2	31.5	31.1	29.6	28.8	29.5	31.7	33.5	33.8
2008	32.9	35.7	34	32.3	31.6	31	29.8	29	29.9	32.1	33.3	33.4
2009	33.5	34.1	34.4	32.9	32.1	30.9	29.6	28.7	30.2	30.6	33.1	34.3
2010	34.2	35.2	34.7	33.8	32.6	31.5	29.7	29.1	30.3	31.9	33.0	33.5

Figure 2 shows the inter annual variations from 2000 to 2010 and on the other hand fig. 3 shows that Benin has one rainfall maximum which is September for 2008 and 2010. The data for 2009 shows a shift from the month of September to October. This shift can have impact on pineapple yield and probably lead to the production of 'kpako'.

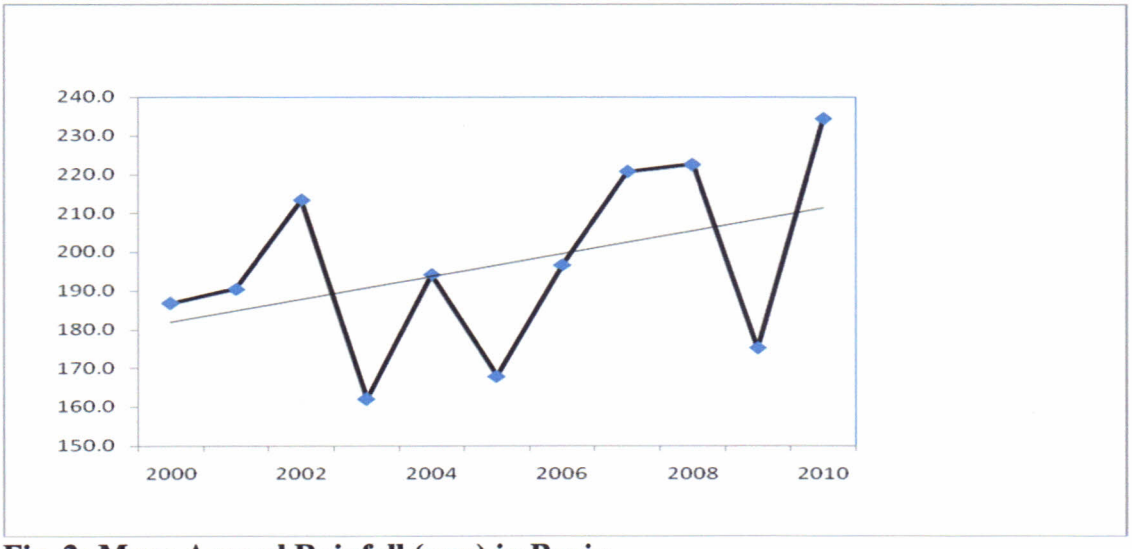

Fig. 2: Mean Annual Rainfall (mm) in Benin

Fig. 3: Monthly Rainfall (mm) in Benin - 2008, 2009 and 2010

Data on Table 4 show that 85% are aware that temperature change, especially the increase, affects their crop. In the area of rainfall, 75% are also aware that early rainfall affects the ripening of their crop. The result shows that the farmers are aware of the impact of climate change. This can be deduced from their answer on the production of 'kpako', specie of pineapple which does not easily ripe. It is rather being used by traditional medicine practitioners to prepare mixture for malaria. 75% of them are aware that temperature increase in the last few years is responsible. Some (65%) are of the view that rainfall is also a major contributor.

Table 4: Awareness of climate change on the production of pineapple by farmers.

Variables	Aware of changes	Not aware of changes
HARVESTING PERIOD		
a) Temperature b) Rainfall	17(85.0%) 15(75.0%)	3(15.0%) 5(25.0%)
TRANSPORTATION PERIOD		
a) Temperature b) Rainfall	-- --	16(80.0%) 17(85.0%)
PRODUCTION OF KPAKO(hard pineapple)		
a) Temperature b) Rainfall	15(75.0%) 14(70.0%)	5(25.0%) 6(30.0%)
SIZES		
a) Temperature b) Rainfall	18(90.0%) 13(65.0%)	2(10.0%)
WASTES		
a) Temperature b) Rainfall	- -	- -

Data on Table 5 show that traders in Ketu market are aware of the changes in the sizes of the pineapple fruit. 93.33% of the respondents (traders) feel that temperature change is a major contributor in the change in the size of the fruit in the last ten years. They are of the view that recent pineapples brought into the market are not as big as the ones they sold some ten years ago. They also noted that 'kpako' is on the increase in recent years. In the area of waste and climate change, their answers show that temperature increase has been affecting the fruit.

Table 5: Awareness of climate change and its impact on the generation of waste by traders in Ketu Market

Variables	Aware of changes	Not aware of changes
HARVESTING PERIOD		
c) .Temperature d) Rainfall	- -	- -
TRANSPORTATION PERIOD		
a) Temperature b) Rainfall	-- --	16(80.0) 17(85.0)
PRODUCTION OF KPAKO(hard pineapple)		
a) Temperature b) Rainfall	9(60.0) 11(73.33)	6(40.0) 4(26.67)
SIZES		
a) Temperature b) Rainfall	14(93.33) 12(80.0)	1(6.67) 3(20.0)
WASTES		
a) Temperature b) Rainfall	13(85.67) -	- -

Table 6 shows that three different vehicles bring pineapple fruit to Ketu market. There is the 911 truck which has nine coaches and each coach contains 60 dozens of pineapple fruit. On the other hand, the pickup van which was usually opted for by traders as a last resort when the 911trucks were not available or when the volume of pineapple low was also considered. The 911 carries more and therefore relatively cheaper than the pickup van and buses. The pickup van can only carry two coaches which make up 120dozens and in most cases more expensive than the 911trucks. The Table 6 also shows the distribution of the wastes generated and the volume of 'kpako' collected each day.

Table 6 : Breakdown of vehicular volume of pineapple and the wastes generated in Ketu Market

Vehicle Type	No. per day	Volume of pineapple carried (Dozens)	Wastes generated (Dozens)	Kpako
911 truck	4	2160	4	8
911 truck	3	1620	3	7
911 truck	5	2700	5	8
911 truck	5	2700	5	8
911 truck	7	3780	6	9
911 truck	6	3240	5	9
911 truck	8	4320	7	9
911 truck	7	3780	6	9
911 truck	7	3780	6	9
911 truck	8	4320	7	10
911 truck	9	4860	8	10
911 truck	9	4860	8	11
911 truck	8	4320	7	10
911 truck	10	5400	8	11
911 truck	9	4860	8	10
Pickups Van/Bus	4	480	1	3
Pickups Van/Bus	3	360	1	3
Pickups Van/Bus	3	360	1	3
Pickups Van/Bus	4	480	1	3
Pickups Van/Bus	5	600	2	4
Pickups Van/Bus	4	480	1	3
Pickups Van/Bus	3	360	1	3
Pickups Van/Bus	5	600	3	4
Pickups Van/Bus	7	840	4	5
Pickups Van/Bus	5	600	3	4
Pickups Van/Bus	5	600	3	4
Pickups Van/Bus	6	720	3	4
Pickups Van/Bus	6	720	3	4
Pickups Van/Bus	7	840	3	5
Pickups Van/Bus	6	720	3	4

RECOMMENDATIONS

Accurate, timely, consistent objective and widely available information, resulting from analysis of the impacts of weather on crop production, improves economic efficiency and provides socio-economic benefits to agricultural producers and consumers alike. The major road linking Edo State and Lagos State should as a matter of urgency should be repaired or concessioned.

CONCLUSION

Pineapple farmers and traders were the target population in this study. They are aware that climate change has been influencing their production. The major areas of focus are mainly the impact on the changes of temperature and rainfall on the production and marketability of their product. In the area of size of the pineapples in recent years, it was by the responses of both the farmers and traders that the size of pineapple has been on the decline. They were of the view that about ten years ago, the sizes of pineapple harvested were bigger than what we have today. They concluded that it could be the problem of low fertility of the soil or the climate change impact. Looking at the production of 'kpako', both the farmers and traders agree that it was climate change that was responsible and this could be seen from the shift in the monthly rainfall peak of Beniin which we saw in 2008, 2009 and 2010.

In conclusion, we are of the view that a more rigorous research has to be undertaken by Universities and research institutes to evaluate the main impact of climate change on the production and distribution of pineapple in our country.

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