

CLIMATE CHANGE EFFECTS ON SUSTAINABLE LIVELIHOOD OF PEASANT COCOA FARMERS IN ONDO STATE, NIGERIA.

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Abstract

Climate is a state of atmosphere which is created by weather events over a long period of time. Effects of climate change on agriculture are often related to variability in local climate rather than in global climate pattern. Based on the fact that over 75% of Ondo State farmers are into cocoa production coupled with irregularities of climate variation effects on cocoa production. It is therefore imperative to determine the influence of climatic change on livelihood sustainability of rural peasant cocoa farmers in the state. Purposive Sampling techniques were employed. Simple random sampling technique was chosen to select 100 peasant cocoa farmers from Idanre Local Government area of Ondo State. Data were analyzed using descriptive statistics such as frequency and percentage. Results showed that (41%) of the respondents are in their active age while 91% of the respondents are married and only 5% of the respondents are widow. The highest proportion of educational level attained by the respondents is on secondary education with (68%) while (52%) of the respondents has between 21-30 years of farming experience and (32%) of the respondents observed rainfall and sunshine as climatic variables that affect cocoa production. From the studies, as a matter of urgency, government should create awareness on climatic change effect as regards its causes; adaptation and mitigation strategies.

Keywords: Climate change, livelihood, cocoa farmers, sustainability.

INTRODUCTION

Cocoa tree belongs to the family of *Sterculiaceae* and the genus *Theobroma*. Its natural habitat is the lower storey of the evergreen rainforest. There are over twenty species in the genus but *Theobroma cacao* is the only one cultivated widely. Since its discovery in the 18th century at the Amazon basin, its cultivation has spread to other tropical areas of south and central America, and indeed West Africa, which became the major producer from the mid 1960s (Opeke, 1987).

Cocoa was introduced to West Africa in the nineteenth century and its introduction to Nigeria is believed to have taken place about 1874 through the Spanish Island Fernando Po (Ayorinde, 1966) when a local chief (Squiss Ibaningo) established a plantation at Bonny in the then Eastern region. The first recorded effort of the government in the

development of cacao cultivation was the distribution of seedling up country for trial planting from the old botanical garden at Ebute-meta, Lagos in 1887 (Opeke, 1987).

One of the earliest commercial planting was made near Ibadan; and the cultivation of cocoa gained its first impetus in Ibadan province, which produced the bulk of Nigeria cocoa up to the early twentieth century.

The two major factors affecting crop yield are weather conditions and erosion (Wright, 1993). Thus, to improve the production of any crop there is need to understand the average weather conditions of such area (observed as the climate), whereby climatic parameters such as temperature, rainfall, humidity as well as sunshine hours affect the agricultural output of any region. Daily, seasonal, or annual variations in the values of the climatic element are of greater importance in determining the efficiency of crop growth (Ayoade, 2004).

These essential resources can be categorized into five classes: physical, natural, human, financial and social. Livelihoods in Nigeria's rural areas derive mainly from agriculture hence physical asset such as arable land and natural ponds become crucial for sustaining peoples' livelihoods. According to the National Bureau of Statistics (2006) about 60% of the national population depends on agriculture for their livelihood. Rural men and women, especially in poor households, engage in diverse and multiple activities to improve their livelihoods by maximizing income-generating activities, while minimizing vulnerability and risk, and achieving other household objectives (improved health, nutrition and education, etc.). These activities may include farm and non-farm actions, many times linked with other activities carried out by rural, as well as non-rural households.

Climate change is any long-term significant change in the expected patterns of average weather of a specific region (or, more relevantly to contemporary socio-political concerns, of the Earth as a whole) over an appropriately significant period of time. Climate change reflects abnormal variations to the expected climate within the Earth's atmosphere and subsequent effects on other parts of the Earth, such as in the ice caps over durations ranging from decades to millions of years.

As the earth warms, scientist predict a change in the climate over crop lands, turning them into deserts, and a melting of polar ice leading to a

rise in sea level and massive flooding of agricultural lands. Agriculture plays a significant role in the economic development of Nigeria. It provides food for over 65% of the population, raw materials for the manufacturing industries, and foreign exchange for the country (Daramola, 2003). Climate is a state of atmosphere, which is created by weather events over a period of time. The effect of climate on agriculture is related to variability in local climates rather than in global climate pattern (Fraser, 2008). Climate change refers to some observable variations in the climate systems that are attributable to human (anthropogenic) activities especially those that alter the atmosphere composition of the earth and ultimately lead to global warming (Opeke 1987). Climate is unstable and has exhibited constant natural fluctuation through time. Studies in the last few decades have also recognized that climate change may be attributed to human activities such as CO₂ emission or removal of the rain forests (Hanspeter, 1995).

The discovery and exploitation of petroleum, (the black gold) led to the decline in the importance attached to the golden crop cocoa. Nevertheless, cocoa still remains the 2nd largest foreign exchange earner after petroleum (Adegeye, 1996). Apart from providing foreign exchange to the exporting countries, cocoa is a means of conserving foreign exchange. This is achieved by producing cocoa based products, for instance cocoa-butter, cocoa cake, cocoa powder, cocoa wine and so on, locally instead of importing them. In the recent years, Nigeria has lost her leading role in exportation of cocoa. This was due to downward trend in cocoa production (Adegeye, 1996). A number of reasons have been given for the decline in cocoa production and of the inability of cocoa industry to increase output. Some of these reasons include small farm holdings, soil fertility, transportation, high cost of labour, low capital, poor market and variability in climatic factors.

However, Ondo State is highly sensitive to climatic factors, most especially rainfall, relative humidity, temperature and sunshine hours. Several views have been expressed about the impacts of irregularity of climatic variation on cocoa production. Some claimed that rural and poor cocoa farmers are most affected; some said that farmers who depend on traditional livelihood system such as farming, fishing and pastorals are most affected while some other researchers claimed that subsistence cocoa farmers are the most affected. Therefore, there is urgent need to examine the climate change effects on sustainable livelihood of Cocoa farmers in Ondo State. Specifically, this study intends to answer the following salient questions.

- what are the socio-economic characteristics of the respondents in the study area?

- how does climate change influence livelihood sustainability activities of cocoa farmers in the, study area?
- what are the problems the farmers encounter during the Cocoa production?
- The objectives of the studies included to
- describe the socio-economic characteristics of the Cocoa farmers in the study area.,
- determine how climate change influence livelihood sustainability of rural cocoa farmers in study area.,
- identify the effect of climate change on Cocoa farms yield.,
- identifying the problems of the small scale holder of Cocoa farmers with a view of providing solution to the identify problems in Ondo State, Nigeria.
- assess how climate change influence livelihood sustainability activities of cocoa farmers in the study area.

Methodology

Study Area

The study was carried out in Ondo State, Nigeria. The state is one of the 36 states of Nigeria and was carved out of the old western states on 3rd February 1976, out of which Ekiti state was carved out in 1996. This state is one of the Yoruba speaking states in the South-West of Nigeria and it is bounded in the west by Osun and Ogun States, in the north by Ekiti and Kogi states. Ondo State also shares boundary with Edo and Delta states in the east and the south by Atlantic Ocean. Ondo State has an area of 14,769 km². The state is made up of 18 Local Government Areas with total population of 3.4 Million inhabitants (2006 Census).

With respect to the climate of the state, it is tropical with two distinct seasons of rainy and dry season. The rainy season occurs between April and October while the dry season begins in November and lasts till April, although in recent times minor alterations are noticeable in rainfall regions due to global climatic change. The state is blessed with 12 diurnal sunshine hours and a moderate all year-round temperature of about 25⁰C.

Annual rainfall varies from 2000mm in the southern part to 1150mm in the northern extremes. The favorable geographical location and climatic condition make the state a veritable agricultural area for the cultivation of diverse crops as well as propagation and utilization of forest resources. Food crops grown include Maize, Yam, Cassava, Plantain, Cocoyam, as well as tree crops like Cocoa, Coffee, Kola-nut, Oil palm, Citrus, Cashew, etc. Forest trees include Teak, Mahogany, Iroko, Afara, Obeche among others. Sequel to the conducive climatic condition of the state, the people engage in livestock production such as Cattle, Sheep, Goat, Piggery,

Poultry, etc. in the riverine areas of the state, inhabitants engage in lumbering, building of Canoes, and with a major occupation of fishing.

Idanre is a Local Government Area in Ondo State, Nigeria. Its headquarters are in the town of Owena. It has an area of 1,914 km² and a population of 129,024 at the 2006 census.

The major occupations of the inhabitants are farming (Cocoa, Timber, Rubber, and Palm Oil Plantation), Civil/Public Service and trading. Their major tribes are Yoruba and Hausa/Fulani and Igbo that migrated to the area as minority. Their religions are Christian, Muslim and Traditional believers.

The LGA has the Yoruba as their major ethnic compositions who are predominantly Christians with few other settlers such as Igbos, Hausas and other tribes. Their major occupations are Civil Servant and Business enterprises with minority engaged with Cocoa farming and artisanship.

Sources of Data

The study made use of both primary and secondary data. Primary data on agricultural activities and other livelihood activities were collected with the use of a well-structured questionnaire. Secondary data were obtained from records and publications from institutions such as Nigeria Meteorological Agency (NIMET), Ministry of Agriculture Ondo State at the meteorology department, relevant textbooks, articles, annual report internet, Ondo State Agricultural Development Programme and other relevant bodies within and outside the country. The data collected include information on the personal characteristics of the respondents such as age, educational level, marital status, livelihood activities, household size and climatic factors that affect their agricultural (Cocoa) productivity.

Table 1: Climatic Variables of Ondo State from 1996 - 2012

Year	Max Temperatures (^o C)	Min Temperatures (^o C)	Relative Humidity (%)	Rainfall (mm)	Contribution percentage of Ondo State to total production (tonnes)
1996	32.7	19.63	76.46	1834.63	44.5
1997	29.08	20.14	73.43	2011.14	46.6
1998	31.20	18.58	81.68	1818.26	50.8
1999	32.10	18.37	77.87	1740.071	46.9
2000	31.70	20.17	77.06	1932.63	56.2
2001	31.13	18.18	78.07	1433.38	46.7
2002	31.70	20.67	76.49	1495.85	36.5
2003	31.89	20.28	73.57	1466.86	29.3
2004	31.34	20.62	76.51	1384.34	27.5
2005	31.55	21.66	77.29	1640.20	19.5
2006	31.46	19.36	77.70	1838.04	20.4
2007	31.89	20.36	75.51	1974.11	31.0
2008	31.75	20.79	70.13	1738.46	29.31
2009	31.77	21.11	73.36	1566.65	29.34
2010	32.50	20.80	77.20	2222.59	38.8
2011	32.23	20.40	75.90	2400.82	29.0
2012	30.69	21.77	77.70	1729.62	30.1

Source: (NiMet)

Sampling Technique

The study was conducted in Idanre, Idanre local government area was mainly producer of cocoa in the study area. However, the purposive sampling technique was followed to draw the study sample, because it is the largest producing area of cocoa in Ondo State. Idanre local government was created in 1991 from old Idanre/ Ifedore Local Government. It has landmarks of about 428km and shares boundaries with Ile-Oluji / Okeigbo, Ondo East, Odigbo, Akure South/ North and Edo-State. The study made use of simple random sampling technique in choosing the respondents interviewed for this study.

Analytical Technique

The descriptive analytical techniques used in the study include frequency, and percentages distribution and measure of central tendencies such as the mean. Four-point Likert scale and Multinomial Logit Regression (MNL) model analysis.

The descriptive statistics were used to analyze the socio-economic characteristics of cocoa farming households, identify the non-farming livelihood activities of the respondents and describe the coping strategies of the cocoa farmers to climate variability. Four point likert scale was used to describe rural household perception about climate change as follows:

Strongly agreed - 4
Agreed - 3
Disagreed - 2
Strongly disagreed -1

Correlation analysis was used to analyze the relationship that exist between major climate parameters (rainfall, temperature and relative humidity) and cocoa yield in the study area

Multinomial Logit (MNL) Regression model was employed to analyze factors influencing farmer's choice of adaptation measures already adopted to mitigate climate change effects in the study area. The dependent variables are adaptation measures already adopted in the study area which were grouped to the following: Diversification (D), Migration of Household (MH), Changing of Planting Dates (CPD), Changing of Harvesting Dates (CHD) Constant Spraying (CS), No Adaptation while explanatory variables for MNL model were Sex, Age, Education, Farm experience, Farm size and Access to Agricultural Extension Services and climate variables (Annual Mean Maximum Temperature in degree centigrade , Annual Mean Minimum Temperature in degree centigrade,

Rainfall in millimeters and Relative Humidity in percentage).

Results and Discussion

Table 1 shows the age distribution of the respondents which indicates that the highest percentage of the cocoa farmers in the study area are between the ages of 51 – 60 years (41%) which is an active age for production this would increase the production efficiency and sustainability of farming practices while few of them about 19 percent and 40 percent are below and above this active age range respectively.

The mean age and standard deviation of the cocoa farmers was estimated as 60 years and 12.38 respectively. Minimum age was 34 years and maximum age is 90 years old. The finding in this study conforms to the findings of Adetunji *et.al* (2007) who observed that cocoa farmers in West African countries in general have an average age of 50 years and above.

Table 2: Age distribution of respondents

Age (years)	Frequency	Percentage %
30 – 40	2	2
41 – 50	17	17
51 – 60	41	41
Above 60	40	40
Total	100	100

Mean Age = 60years; S.D = 12.3Source: Field survey,2012

Table 2 revealed that 91 %, of the respondents are married, which shows that they can have the support of their household members in their cocoa production in addition to hired labourers and this would increase cocoa production while 4 % of the respondents are single which could account for the

younger generation that may have inherited from their parents and 5 % are widowed which probably have taken over from their late husband(s).Odebo *et.al.*, (2006) reported that farmers in their prime age are favourable to cocoa production since cocoa farming requires intensive labour.

Table 3: Marital status distribution of respondents

Marital Status	Frequency	Percentage (%)
Married	91	91
Single	4	4
Widowed	5	5
Total	100	100

Source: Field Survey,2012

A larger percentage of the respondents (61%) have household sizes of between 6 and 10 makes enough personnel available for production activities. This however renders them to more responsibilities as they have a number of dependent.

Minority groups of household members 1 – 5 and above 10 account for (18%) and 21% of the respondents. This result indicated that only few members are either under dependent or over dependent among the cocoa farming populace in the study area.

Table 4: Household size distribution of respondents

Household size	Frequency	Percentage (%)
1 – 5	18	18
6 – 10	61	61
Above 10	21	21
Total	100	100

Source: Field survey,2012

Educational qualification distribution of respondents

Education is an important factor which influences farm productivity; it determines the farmers' access to information and adoption of new farming innovation, skills and ability to adopt new technology. Table 5 indicates that most of the respondents are literate. The highest proportion of educational level attained by the respondents is

secondary educational level by 68 % of the respondents. 14 % attained tertiary education level, (7%) attained primary education while 6 % attained modern school. However, a very few percentage of them (5%) had informal education. Their educational level will therefore influence their readiness and ability to adopt innovations and ideas capable of improving their production activities.

Table 5: Educational qualification distribution of respondents

Educational Qualification	Frequency	Percentage (%)
Primary	7	7
Modern School	6	6
Secondary	68	68
Tertiary	14	14
None	5	5
Total	100	100

Source: Field survey, 2012

Results from Table 5 reveals that about 20% of the respondents are into trading activities such as sales of raw food items, provisions and sales of agricultural produce like vegetables, plantain, garri, palm-oil and so on. Only 17% are into hard work such as shoe making carpentry, bricklaying, broom making, weaving (hairdressing), tailoring and

so on. A greater proportion of them (28%) are civil servants whose farms are solely managed by labourers. Majority of the respondents (35%) are into food processing such as cassava processing, oil palm processing. This result indicated that majority of the respondents find it easy to process food because of high level of education attainment.

Table 6: Other income generating activities of Cocoa farmers

Source of income	Frequency	Percentage (%)
Trading	20	20
Hand work	17	17
Civil servant	28	28
Food processing	35	35
Total	100	100

Source: Field survey,2012.

Farming experience of respondents

Table 6 reveals that 52% of the respondents had between 21-30 years of Farming experience while 21% of the respondents had farming

experience over 30 years.Evidence thus suggest that majority of the respondents had lengthy farming experience and should be able to make the right

decision on the use of input to increase their cocoa production.

Table 7: Farming experience of respondents

Duration (years)	Frequency	Percentage (%)
1 – 10	2	2
11 – 20	25	25
21 – 30	52	52
Over 30	21	21
Total	100	100

Source: Field survey, 2012.

Farm size of respondents

The hectares of farm land cultivated by Cocoa farmers have always been known to have a direct relationship with output. Most increase in food production has always resulted from increases in hectare of land cultivated. Table 7 shows a larger percentage (85%) of the respondents have farm size

ranging from 1 to 5 hectares with just 12% of them having farm size of between 6 to 10 hectares with just 3 % of them having greater than 10 hectares. This shows that majority of farmers have adequate land available for a substantial production level, hence this would increase the cocoa production.

Table 8: Farm size distribution of respondents

Farm size (ha)	Frequency	Percentage (%)
1 – 5	85	85
6 – 10	12	12
> 10	3	3
Total	100	100

Average farm size: 4.09ha

Source: Field survey, 2012

Means of land acquisition

A very large percentage (65%) of the cocoa farmers in the study area acquired their lands by inheritance while 35 percent acquired theirs by purchase. This implies that most of the farmers inherited the farming business from their ancestors. They would have however stayed long on the cocoa farming enterprise and would easily notice the effect of climate variability on the production as soon as it occurs.

Farming Income and Non-Farming Income Activities

Source of credit for farming operations

The results in the table 10 revealed that majority of the farmers (39%) obtain credit from the merchant lenders who eventually buy the colon beans when they ready for market. However, 21 % raise fund by personal savings. About 30% also obtained their credit from both personal savings and merchant lenders. Other (10%) obtained theirs from the local money lenders. This usually influence price determination and render the cocoa business less profitable for them since it is the merchant men that finances the production that usually fix the prices of cocoa.

Table 9: credit for farming operations

Source	Frequency	Percentage (%)
Money lenders	10	10
Personal savings	21	21
Merchant lenders	39	39
Personal savings and merchant lenders	30	30
Total	100	100

Source: Field survey, 2012

Utilization of credit

The credits obtained by cocoa farmers are generally used in the maintenance of the cocoa farm. It is used for activities which include purchase of seedlings of cocoa, acquisition of agro chemicals such as fertilizers and pesticides and fungicides. They also use part of the money for their upkeep in terms of payment of children school fee, domestic bills and feeding.

Estimated Income from Cocoa by Respondents (₦/annum)

The annual income obtained by majority of the farmers i.e (44%) is between ₦100,000 and ₦199,000 per annum. 40% earn between ₦200,000 and ₦299,000 while 10% earn between ₦300,000 and ₦399,000. However 4% earn less than ₦100,000 per annum and first 2% of them earn above ₦400,000 per annum..

The income obtained is the portion accrued to the farmers after settlement of all payments and debts. This means that cocoa business is a profitable business to most cocoa farmers.

Table 10: Income distribution from Cocoa (₦/annum)

Income(₦/annum)	Frequency	Percentage (%)
Less than 100,000	4	4
100,000-199,000	44	44
200,000-299,000	40	40
300,000-399,000	10	10
400,000 and above	2	2
Total	100	100

Source: Field survey, 2012

Estimated income from other income generating activities

From other income generating activities aside cocoa farming, majority(74%) of the respondent earn between ₦50,000 to ₦100,000 per annum, about

15% earn less than ₦50,000 while 11% of them earn above ₦100,000. Other income generating activities include shoe making, food processing, sales of food items, handset repair.

Table 11: Estimated income from other income generating activities

Income (₦/annum)	Frequency	Percentage(%)
Less than 50,000	15	15
50,000 - 100,000	74	74
100,000 - 200,000	11	11
Total	100	100

Source: Field Survey, 2012.

Climate Variability

All the respondents agreed that the weather is changing from time to time. This awareness will therefore prepare them to take necessary measures to combat the effect of the climate change. Table 12 reveals that 18% of the cocoa farmers agreed that rainfall only affects their cocoa production, 24% of the respondents reported that sunshine affect their

cocoa production while 16% of the respondents enumerated that (temperature) affects their cocoa production. 32% choose rainfall and sunshine while the remaining 10% choose rainfall and temperature. This result indicates that Rainfall, Temperature and Sunlight are the major climatic variables that affect cocoa production respectively.

Table 12: Climatic variables that affect cocoa production

Climatic Variables	Frequency	Percentage (%)
Rainfall	18	18
Sunshine	24	24
Temperature	16	16
Rainfall and Sunshine	32	32
Rainfall and Temperature	10	10
Total	100	100

Source: Field Survey, 2012.

Change in climatic pattern

A larger percentage (70%) of the respondents noticed that there was low and delayed in rainfall, 20% of the respondents stressed that they observed unfavourable sunlight while 10% of the respondents attest that it was high temperature that they observed. The delayed and low rainfall according to the respondents will lead to delay edin fruiting and also reduced yield of cocoa. However, it could be

observed that delay could lead to emanation of pest and disease attack on cocoa trees. The high sunshine also could lead to untimely ripening of immature cocoa pods thus reducing the cocoa beans quality after harvest. The sunshine at times could also be low hence disturbing the drying process of cocoa process therefore leading to the moodiness and spoilage of the cocoa beans and reduces the aroma of the cocoa beans.

Table 13: Observed changes in climatic pattern

Climate change	Frequency	Percentage (%)
Low rainfall	70	70
High temperature	10	10
Unfavourable sunlight	20	20
Total	100	100

Source: Field survey, 2012

Duration of change of climatic parameters

According to the distribution in table 14, a larger proportion of the respondents (37%) noticed climate change for more than five years ago, 21% noticed from the past four years, 16% of them noticed the

change from the past three years while 13% each noticed from two years ago, and last year. This observation implies that the notice and awareness of climate change among the respondents has been for a considerable period of time.

Table 14: Duration of notice about climate variability

Duration	Frequency	Percentage (%)
Last year(2011)	13	13
Last two years(2010)	13	13
Last three years(2009)	16	16
Last four years(2008)	21	21
Last five years and above	37	37
Total	100	100

Source: Field survey, 2012

Effects of climatic variability

The climatic failures noticed on cocoa production by the respondents were reduced to 57% pest and disease conditions by 21% Mouldiness of cocoa beans by 22%. All these failures will lead to reduction of cocoa yield and thus render the cocoa enterprise Unprofitable or less profitable to the farmers and drastically reduce the a locative and production efficiency of cocoa production. These

failures will also make the farmers spend more on procurement of excess seedlings and in the control of pests and diseases. However, according to Mbanasor *et al.*, 2010 state that increasing consensus among actors about a mounting threat due to climate change. Available evidence suggests that countries in temperate and polar locations may benefits from economics because additional warning will be advantage to agricultural productivity.

Table 15: Perceived effects of climatic failure by the cocoa farmers

Effects	Frequency	Percentage (%)
Reduced weight	57	57
Diseases and pest	21	21
Mouldiness' of cocoa beans	22	22
Total	100	100

Source: Field survey, 2012

Conclusion and recommendation

Climate variability is an international phenomenon that affects people across the world with different perceived effects such as flood, drought, windstorm, heavy or reduced precipitation events, frequency in the increase and intensity of heat among others. The

vulnerability of rural households to these climate changes includes disease, health hazard, decline in agricultural production, global warming and so on. This research work showed that cocoa farmers in Ondo state are vulnerable to climate change in the area of variability in sunshine hours, temperature

and relative humidity which cause reduction to cocoa production. Resurgence of pest and disease infestation, mouldiness of cocoa beans and unfavourable weather condition resulted to low income of the farmers in the affected areas. This therefore makes the farmers to develop coping and adaptation strategies such as diversification, migration of household heads and sought of off-farm employment so as to combat or overcome the negative effects of climate change and develop a means of improving their livelihood. Based on the findings, the following recommendations were made to ensure increase in the output of cocoa in Ondo State and also ensure a means of sustainable livelihood among cocoa farmers.

- The government should create awareness on climate change as regards its causes, effects and mitigation strategies.
- The farmers should be given orientation on various coping and adaptation strategies that can assist them in cocoa production.
- The farmers should be assisted by the governmental and non-governmental organisations on how to develop a means of sustainable livelihood such as financial empowerment, training on skill acquisition, so as to have other alternatives to generate income apart from cocoa production.
- Government and other stake holders in cocoa sub-sector should make efforts to encourage the involvement of younger generations in cocoa production as most of the people interviewed were aged farmers, while youth involvement will ensure a better understanding of the concept of climate change, its effect and adaptation strategies.
- Farmers should be encouraged to belong to a cooperative group in order to contribute and utilize their resources together to obtain easy means of livelihood and to get funds to finance their cocoa farming business.

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