# CREDIT USE AND PRODUCTION EFFICIENCY OF COCOA FARMS IN ONDO STATE, NIGERIA

Oladapo, A.[1], Shittu, A.M.[2], Agbonlahor, M.U.[2] and Fapojuwo O.E[3]

[1]Department of Agricultural Technology, Rufus Giwa Polytechnic, P.M.B. 1019, Owo, Ondo State, Nigeria.

[2]Department of Agricultural Economics and Farm Management, Federal University of Agriculture, P.M. B. 2240 Abeokuta, Ogun State, Nigeria

[3]Department of Agricultural Administration, University of Agriculture, P.M.B. 2240, Abeokuta, Ogun State, Nigeria

## Abstract

This study analyzed the pattern of access/use of credits by cocoa farmers in Ondo State and its effect on technical efficiency in cocoa production. The study was based on primary data obtained by interviewing a cross-section of 183 randomly selected cocoa farms. These were drawn in a multi-stage sampling process that covered the five dominant cocoa producing Local Government Areas (LGAs) of Ondo State Nigeria, namely: Idanre, Ondo West, Odigbo, Owo, and Akure South. The data were analyzed using descriptive and stochastic frontier methods. The study found that most (95.1%) of the cocoa farms were operated by males, with a mean age of 49.8years. Majority (66.7%) had no more than primary school education. Only 58.5% of the cocoa farmers used credit during the 2009/2010 production season. The mean amount procured during the production season was ₦66, 259.02. These were procured mostly (83.2%) from produce merchants. Increase in credit use was revealed to be associated with significant ($p<0.05$) reduction in technical inefficiency among the cocoa farms. Hence, the study recommended that government and other stakeholders should support enhanced credit delivery, most especially through the produce merchant system in the study area.

**Keywords:** Credit use, Technical efficiency, Cocoa production, Nigeria

## Introduction

The cocoa industry has been a driver of economic growth in many cocoa growing economies, with the World witnessing rapid growth in cocoa production over the course of the twentieth century (Nkamleu, *et.* al. 2010 and Gray, 2001). The industry however, suffered a couple of setbacks over the past three decades, the causes and extent of which varied widely among cocoa growing economies. In Nigeria, a neglect of the agricultural sector in pursuit of cheap oil money led to sharp decline in cocoa production during the last three decades of the 20$^{th}$ century. Evidence based on FAOSTAT data (FAO, 2012) showed that cocoa production figure in Nigeria declined steadily from 304,800 metric tonnes in 1970 to as low as 148,000 metric tonnes in 1986. While various policy reforms adopted to revert the trend, starting with the Structural Adjustment Programme (SAP) in 1986, saw cocoa production figures in the country picking up slowly to 2440,000 metric tonnes by 1990 and 485,000 by 2004, the figures tend to fluctuate sharply from year to year, and have recently been on a decline, dropping again to 367,020 by 2008 and 360,000 by 2010 (FAO, 2012).

Close examination of Nigeria's cocoa production statistics reported in FAOSTAT data point at declining productivity as a key factor responsible for most of the cocoa output declines recorded over the past four decades. For example, the area harvested was stagnant at 700,000 hectares throughout the period 1960 - 1988, and rose steadily thereafter to 966,000 hectares by 2000 and 1,344,500 hectares by 2010. Meanwhile, cocoa yield that had grown steadily from 284kg/Ha in 1960 to 435kg/Ha by 1970 declined steadily to 211kg/Ha in 1986, while the recent output decline was also because yield that had risen with reform to 350kg/Ha by 2000 fell recently to 268kg/Ha by 2010 (FAO, 2012). This call to question effectiveness/impact, on the cocoa sector, of various research and developmental activities aimed at promoting intensification of agricultural production in Nigeria through increased modern input use and introduction of high-yielding varieties. Moreover, bearing in mind that cocoa is a long gestation crop, fluctuations from year to year and the recent declining yield is most likely a result of growing operational inefficiency within the cocoa sector.

Available evidence in literature suggest that the liberalization reforms adopted since SAP in 1986, leave farmers to the vagaries of the market, with access to modern inputs such as improved seeds/seedlings, fertilizers and other agrochemicals becoming more difficult and expensive as input distribution has passed from the public to the private sector, and subsidies have been reduced or removed. Some estimates put yield losses due to uncontrolled diseases that are primarily a result of inadequate use of appropriate chemical (see for example, Appiah *et al.*, 1997; and Pretty, 1995) at between 10% and 80% (NRI, 2004). This together with other factors such as lack of access to quality inputs, low level of technical knowledge and poor technology transfer have been identified as possible causes of the declining cocoa yields in Nigeria (Okoruwa and Oni, 2001).

The fact that various commodity boards, whose activities tend to stabilize market prices, were abrogated with governments' trade liberalization reform that started with SAP in Nigeria in 1986 have also meant that market prices for cocoa have been unstable ever since. Evidence in literature (e.g. Kazianga, 2002) have shown that the main way cocoa farmers in West Africa respond to fall in market prices is by reducing the quantity of inputs (pesticides, fungicides, etc) they apply to their tree stock, which ultimately lead to yield declines. The case is made worse by the fact that they often lack access to affordable credit (Killick, 1999) that could have cushion effect of such price decline on their income and investible surplus.

The need for some access to credit among resource-poor farmers cannot be overemphasised. It is required to finance working capital and investment in fixed capital, particularly among farmers that are too poor to accumulate much saving. It is an important instrument for smoothing consumption, in a context where incomes typically experience large seasonal fluctuations. Availability of credit reduces reluctance to adopt technologies that raise both mean levels and riskiness of incomes (Aghion and Bolton, 1997). Hence, it has been a long-held belief among researchers and policymakers that lack of adequate access to credit among cocoa farmers in West Africa impacts negatively on aggregate and household level-incomes, technology adoption, agricultural productivity, and overall household welfare (Alderman and Paxson, 1992; Besley, 1995; Delgado, 1995; Diagne and Zeller, 2001).

It is against this background that this study assesses the pattern of credit access and use among cocoa farms in Ondo State, and the effects on production efficiency. The rest of the paper is organised as follows: the next section presents the study methodology. The third presents the results and discussion, while the final section presents the conclusion and recommendation.

**Methodology**

The Study Area:
The study was carried out in selected cocoa growing communities in five Local Government Areas (LGAs) of Ondo State, namely Idanre, Ondo West, Odigbo, Owo and Akure South LGAs in Ondo State, in the Southwest rainforest zone of Nigeria. The state covers an area of 14,788.723 sq km. It lies in between longitude $4^0 31$ and $6^0 00$' East and latitude $4^0 15^1$and $8^0 15^1$ North. The state is bounded by Ekiti and Kogi State in the North; in the East by Edo State; in the West by Ogun and Osun States and in the south by the Atlantic Ocean. There are three distinct ecological zones within the state. These are the mangrove forest to the south, the rainforest to the middle belt and the Savannah to the North. The state has an annual rainfall ranging from 2,000mm in the southern parts to 1200mm in the Northern areas with the raining season running between March and October. The 2006 National population census provisional results indicated that the population of Ondo State was 3,441, 024 as at March 2006 (NPC 2006).

Study Data and Sampling:
The study was based on primary data obtained in a cross-section survey of cocoa farms in the study area. The data were collected by interviewing the respondents. The cocoa farmers interviewed were selected using a multi-stage sampling process. First, five LGAs - Idanre, Ondo West, Odigbo, Owo and Akure South - were purposively selected based on information from Ondo State Agricultural Development Programme office that suggest they were the dominant cocoa producing area in the state. Second, random sampling technique was used to select four villages from each Local Government and while snowball sampling was used to identify an average of 10 cocoa farmers from each of the villages in the final stage, adding up to a target 200 respondents. However, reliable information could only be obtained 183 respondents whose data were analysed.

Analytical Procedure:
The study data was analysed using descriptive and Stochastic Frontier methods. Simple frequency distribution and percentages were used to describe the socio-economic characteristics of the respondents. The influence of credit on technical efficiency in cocoa production was assessed within the framework of the Stochastic Production Frontier of Battese and Coelli (1995).

Model Specification:

The stochastic production frontier for cocoa production in the study area is specified as follows:

$Y_i = f(X_i\beta_i) + (vi - ui)$ ……. (1)

Where:

Yi is the output of the $i^{th}$ farm (Kg)
$X_i$ is a vector of input quantities of the $i^{th}$ farm, including:
$X_i$ = farm size (ha),
$X_2$ = Household labour (manday),
$X_3$ = Hired labour (manday)
$X_4$ = Cost of intermediate material use including pesticides, fungicide, etc. (₦),

$\beta$ is the vector of unknown parameters to be estimated

$V_i$ are random variables which are assumed to be normally distributed and independent of Ui. It is assume to account for measurement error and other factors not under the control of the farmers.

$U_i$ are non-negative random variables associated with technical inefficiency in production. They are assumed to be independently distributed as truncation at zero of the $N(m_i, \sigma^2_u)$ distribution, where:

$$m_i = \delta o + \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 \quad (2)$$

Where

$m_i$ is the conditional mean of $U_i$

$Z_i$ is age of the cocoa farmer (years),

$Z_2$ is gender of the cocoa farmer (Female=1, Male = 0),

$Z_3$ is age of cocoa farm (years)

$Z_4$ is the square of age of the cocoa farm square (years),

$Z_5$ is years of formal schooling by of the cocoa farmer (years)

$Z_6$ is the experience of cocoa farmer (years),

$Z_7$ is a dummy variable on credit use (Credit User = 1, Non-User = 0)

$Z_8$ is the quantum of credit secured (N)

$\delta_0$, $\delta 1$, $\delta 2$, ------$\delta_8$ are parameters to be estimated.

Parameters of the stochastic production frontier and technical inefficiency model were estimated using the Frontier 4.1 econometric software. The program also generated the technical efficiency index (TE) for each farm, which Coelli (1996) shows are computed as follows:

$$TE = E(Y^*|U_i, X_i) / E(Y_i^*|U_i=0, X_i) = \exp(-U) \quad (3)$$

**Results and Discussion**

Personal characteristics of Cocoa Farmers:

The personal characteristics of the cocoa farmers as summarised in Table 1. As shown on the table, only 10.9% of the cocoa farmers were youths aged 30 years or younger. The average age was 49.8 years, with about a quarter (24.6%) being older than 60 years. As shown in Table 1, the cocoa farmers were predominantly male (95.1%) with only a few females (4.9%) operating cocoa farms in the study area. Majority (90.7%) of the respondents are married while the remaining (9.3%) are either single or widowed.

While majority (67.2%) of the farmers were literate, about two-third (66.7%) had no more than primary school education while about one-third (32.8%) had no formal education. The main implication of this is that a sizeable number of the cocoa farmers may not be able to decode instructions expressed in English language, and as a result may not be able to benefit maximally from extension services.

Credit Use and Sources:

Table 2 presents the distribution of cocoa farmers by use/non-use of credit, the credit source and provide a descriptive statistics of the average amount of credit accessed from various sources. As shown on the table, it was barely about half (58.47%) of the cocoa farmers that

reported they were able to procure and used some credit during the 2009/2010 production season. Most (83.2%) of these credit users procured the credit through the produce merchants with only 7.5% of the cocoa farmers reporting they secured credit from a Cooperative Societies, and none reported use of credit from banks or any other formal financial institutions.

The average amount of credit procured from the Produce Merchants was N110, 313.58, while an average farmer in the sample was only able to procure N66, 259.02 during the 2009/2010 production season.

Estimated Production Frontier of Cocoa:
The maximum likelihood estimates of the parameters of stochastic production frontier (SPF) of cocoa farms in the study area, and the associated technical inefficiency equation are summarised in Table 3. The variance parameters as represented by sigma squared ($\delta^2$) and gamma ($\gamma$) were found to be statistically significant at 1% level. This shows that systematic source influences that are unexplained by the production function are the dominant sources of random error. The parameter gamma was 0.9718, which implies that about 97.2 percent of the variations in cocoa farmers output in the study area are due to technical inefficiency in production. Hence, the ordinary least squares (OLS) estimate of the production function would be inadequate in explaining cocoa production in the area.

As shown on Table 3, the significant parameters in the estimated SPF was the intercept, coefficient of hired labour which was significant at 1% level and coefficient of expenses on intermediate materials including insecticides, fungicides and other agrochemicals, which was significant at 10% level. This shows that cocoa output in the area is predominantly explained by increase in hired labour use and intermediate materials. The fact that the variance parameters were also significant at 1% level also shows that significant technical inefficiency exists in the production systems of the cocoa farms. The mean index of technical efficiency (TE) was found to be 0.44, which implies that achieved output of an average farmer in the sample is 56% less than the achievable output.

Sources of Technical Inefficiency:
The influence of various factors, include credit use, on technical inefficiency in cocoa production is presented in the middle section of Table 3. As shown on the table, coefficient of the dummy variable associated credit use and the coefficient associated with the amount of credit secured were both negative and significant at 5% and 1% levels respectively. This shows that credit use significantly lowered technical inefficiency level of the cocoa farms, with the level of technical inefficiency declining significantly ($p<0.01$) with increase in the amount of credit procured.

The coefficient of gender (Female = 1, Male =0) is positive and statistically significant at $p<0.01$. This implies that the level of technical inefficiency in cocoa production is significantly much higher on an average farm operated by a female than what obtains on an average farm operated by n male. Parameters associated with age of the cocoa plantation and education levels of the cocoa farmers were the other coefficients that were statistically significant in the inefficiency equation. The coefficient of squared age of the cocoa plantation is positive and significant at 1% level. This implies that the level of technical inefficiency in cocoa production declines initially with increase in age of the cocoa plantation, and rise in later years as the plantation ages. This conform with *a-priori* expectations, given that output of a cocoa plant initially picks up as the cocoa plant matures, and tend to decline in later years as the plantation ages. Evidence in respect of education also conform to *a-priori* expectations as the coefficient is negative and also significant at 1% level, implying that increase in level of education tends to lower production inefficiency among the cocoa farms.

## Conclusion and Recommendation

The central theme of this study has been to examine the influence of credit use on production efficiency cocoa farms in Ondo State, Nigeria. Based on data collected from a cross-section of 183 cocoa farms analysed using descriptive and stochastic production frontier methods, the study found that there was very little or no access to formal credits among the cocoa farmers in the study area. None reported access to any bank/other institutional credit during the 2009/2010 production season, while only 7% secured some credit from Cooperative Societies. However, informal credit sources dominated by the produce merchants came to the rescue of about half (58.47%) of the cocoa farmers through whom an average cocoa farmer in the sample secured an average of ₦66, 259.02 as credit during the 2009/2012 production season.

Stochastic production frontier analysis revealed that significant technical inefficiency exists in cocoa production systems in the study area. The mean technical efficiency index was estimated to be 0.41; implying that an average farmer in the study area can still double their output without any change in the level of resource use, if factors causing production inefficiency are put on check. The level of technical inefficiency was found to be significantly lower on farms operated by farmers that were able to secure some credit, and declined significantly with increase in volume of credit accessed. Hence, the study concludes that credit access enhances production efficiency of cocoa farms in the study area. Production efficiency is also significantly enhanced by increase in level of educational attainment of the farmers as well as by operating a cocoa farm that is in its prime. The study thus recommends support for increased credit delivery, most especially through the produce merchant system for increased production efficiency in the State.

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Table 1: Distribution of Respondents by personal Characteristics

| Description | Frequency | Percent |
|---|---|---|
| **Age (years)** | | |
| 30 or less | 20 | 10.9 |
| 31 – 40 | 51 | 27.9 |
| 41 – 50 | 37 | 20.2 |
| 51 – 60 | 30 | 16.4 |
| Above 60 | 45 | 24.6 |
| Total | 183 | 100.0 |
| **Gender** | | |
| Male | 174 | 95.1 |
| Female | 9 | 4.9 |
| Total | 183 | 100.0 |
| **Marital Status** | | |
| Single | 10 | 5.5 |
| Married | 166 | 90.7 |
| Widow | 7 | 3.8 |
| Total | 183 | 100.0 |
| **Education level** | | |
| No formal education | 60 | 32.8 |
| Primary school | 62 | 33.9 |
| Secondary school | 48 | 26.2 |
| Tertiary | 13 | 7.1 |
| Total | 183 | 100.0 |
| **Cocoa farming experience (years)** | | |
| 1 - 10 | 52 | 28.4 |
| 11 - 20 | 55 | 30.1 |
| 21 - 30 | 24 | 13.1 |
| Above 30 | 52 | 28.4 |
| Total | 183 | 100.0 |

Source: Field survey 2010

Table 2: Pattern of Credit Use by Sources

| **Credit Source** | **Number** | **%** | **Mean** | **Std. Error** |
|---|---|---|---|---|
| None | 76 | 41.53 | - | - |
| Friends & Relatives | 11 | 6.01 | 62,272.73 | 13,062.15 |
| Produce Merchants | 81 | 44.26 | 110,313.58 | 17,348.09 |
| Cooperatives | 7 | 3.83 | 42,142.86 | 15,269.68 |
| Friends, Relatives & Produce Merchants | 7 | 3.83 | 262,857.14 | 90,250.03 |
| Friends, Produce Merchants & Cooperatives | 1 | 0.55 | 370,000.00 | . |
| **Average Farmer** | **183** | **100.00** | **66,259.02** | **9,769.42** |

Source: Field Survey, 2010

Table 3 Maximum Likelihood Estimates of Parameters of Cobb-Douglas Stochastic Frontier Production Function for Cocoa Farmers in Ondo State.

| Variable | Parameters | Coefficient | t-value |
|---|---|---|---|
| **Production Frontier** | | | |
| Constant | $\beta_0$ | 6.735*** | 10.12 |
| Farm size ($X_1$) | $\beta_1$ | 0.012 | 0.05 |
| Household labour ($X_2$) | $\beta_2$ | 0.055 | 0.10 |
| Hire labour ($X_3$) | $\beta_3$ | 0.605*** | 2.97 |
| Cost of intermediate materials | $\beta_4$ | 0.252* | 1.91 |
| | | | |
| **Inefficiency Model** | | | |
| Constant | $\delta_0$ | -2.908 | -1.12 |
| Age | $\delta_1$ | 0.026 | 0.84 |
| Gender (Female =1) | $\delta_2$ | 8.960*** | 4.02 |
| Age of cocoa farm | $\delta_3$ | -0.361*** | -3.25 |
| Age of cocoa farm square | $\delta_4$ | 0.008*** | 3.57 |
| Education | $\delta_5$ | -3.282*** | -3.53 |
| Experience | $\delta_6$ | 0.063* | 1.80 |
| Credit Use (Credit user =1) | $\delta_7$ | -1.958** | -2.13 |
| Amount of credit | $\delta_8$ | -0.004*** | -13.08 |
| | | | |
| **Diagnostic Statistics** | | | |
| Sigma square | $\delta^2$ | 8.9983*** | 4.17 |
| Gamma | $\gamma$ | 0.9718*** | 57.54 |
| Mean Technical Efficiency | 0.44 | | |

Source: Computed from Field Survey, 2010.