International Journal of Agriculture, Environment and Bioresearch

Vol. 09, No. 06; 2024

ISSN: 2456-8643

DETERMINANTS OF ADOPTION LEVELS OF COCOA CERTIFICATION PROGRAMME IN SOUTHWEST, NIGERIA

Abdulfatah Yusuf[1,2], Lawrence Olusola Oparinde[2,3], Jimoh Atanda Afolabi[2], Joseph Olumide Oseni[2], Jonathan Ayodele Olowogbayi[1]

[1]Agricultural and Rural Management Training Institute (ARMTI), P.M.B 1343, Ilorin, Kwara State, Nigeria.

[2]Department of Agricultural and Resource Economics, Federal University of Technology, P.M.B 704, Akure, Ondo State, Nigeria.

[3]Department of Agricultural Markets, Institute of Agricultural Policy and Markets, University of Hohenheim, Stuttgart, Germany.

https://doi.org/10.35410/IJAEB.2024.5946

ABSTRACT

This study examines the determinants of adoption levels of cocoa certification programs among smallholder farmers in Southwest Nigeria. Cross-sectional data were used and collected with the aid of a well-designed questionnaire. Using a multi-stage sampling technique, 396 respondents were selected across two states renowned for their cocoa production capacity. Data were analyzed using an ordered probit regression model to assess the influence of socio-economic, demographic, and institutional factors on adoption levels. The study found that certification adopters were predominantly male (79.5%) and aged 31-60 years (76.5%), with higher education levels and moderate household sizes (4-9 members). Adopters had more farming experience and medium-sized farms (4-6 hectares). Key factors influencing the level of adoption included age, household size, gender, education, farm size, farming experience, financial risk, credit constraints, and access to extension services. Age exhibited a negative and significant effect, indicating that younger farmers are more likely to adopt certification programs. Household size, gender, non-cocoa income, collateral, and access to extension services positively influenced adoption levels. Conversely, financial risk and farm size negatively affected adoption levels, highlighting the challenges faced by farmers with larger holdings and those exposed to higher financial risks. Despite certification offering potential benefits such as improved market access and premium pricing, the adoption rate remains low due to financial and institutional barriers. The study recommends targeted interventions, including subsidies for certification costs, enhanced access to credit, strengthened extension services, and gender-inclusive policies, to promote broader adoption.

Keywords: Adoption levels, cocoa certification, farmers, financial risk, ordered logit regression, Nigeria.

1. INTRODUCTION

Cocoa production plays a pivotal role in the socio-economic landscape of many tropical countries, providing livelihoods to millions of smallholder farmers and contributing significantly to foreign exchange earnings (Oseni et al., 2018; Olutumise et al., 2019; Adegoroye et al., 2024). Among the world's leading producers, Nigeria stands out as the fourth-largest cocoa exporter, with an annual production of 328,263 metric tons in 2020 (International Cocoa Organization [ICCO], 2020). The Southwest region of Nigeria is the heart of cocoa production, accounting for over 70% of the country's output (FAOSTAT, 2021). This region benefits from a favourable climate and soil conditions conducive to cocoa cultivation. Despite its importance, cocoa

Vol. 09, No. 06; 2024

ISSN: 2456-8643

production in Nigeria faces significant challenges that threaten its sustainability and farmers' welfare. One pressing challenge is the reliance on traditional farming practices, which often result in low productivity, vulnerability to climate shocks, and market volatility. Farmers are also constrained by limited access to finance, technical knowledge, and market infrastructure, exacerbating their economic instability (Barham & Weber, 2020). To address these challenges, certification programs have been introduced as a potential pathway to sustainable cocoa farming. These programs, implemented by organizations like Fairtrade, Rainforest Alliance, and UTZ, aim to enhance farm productivity, improve environmental practices, and secure better livelihoods for farmers through premium pricing and market access (Adegoroye et al., 2024). Certification programs set standards for social, economic, and environmental sustainability, offering farmers the opportunity to integrate into global value chains under fairer terms (Akinrotimi, 2024).

However, the adoption of certification programs in Nigeria remains limited (Akinrotimi et al., 2024). Studies indicate that less than 30% of Nigerian cocoa farmers participate in certification schemes, a figure significantly lower than that of other major cocoa-producing countries like Ghana and Côte d'Ivoire (Oseni et al., 2018). This low adoption rate raises concerns about the factors hindering widespread participation. Previous research has highlighted barriers such as financial constraints, lack of awareness, and inadequate institutional support (Olawale et al., 2021, Oluwalade et al., 2023; Akinbola, 2023). Additionally, demographic characteristics such as age, education, and gender play critical roles in determining the willingness and ability of farmers to adopt certification practices (Awoyemi & Salman, 2020).

Again, certification programs represent a transformative approach to addressing the challenges faced by cocoa farmers. These programs aim to achieve sustainability by encouraging environmentally friendly practices, reducing the use of harmful pesticides, and promoting biodiversity (Trujillo-Barrera et al., 2020). Socially, certification mandates compliance with labour laws, including the prohibition of child labour and the provision of fair wages, ensuring ethical practices within the cocoa supply chain (Akinwale et al., 2022). Economically, certification offers farmers access to premium prices, credit facilities, and technical training, which can significantly improve their welfare and reduce poverty levels (Akinrotimi et al., 2024).

Studies from other cocoa-producing countries provide evidence of the positive impacts of certification. In Ghana, Fairtrade-certified farmers reported an average income increase of 15%, alongside improved food security and educational opportunities for their households (Asante et al., 2021). Similarly, research in Côte d'Ivoire found that Rainforest Alliance-certified farmers achieved a 20% reduction in production costs due to better farm management practices, further enhancing profitability (Kouadio et al., 2022). These findings underscore the potential of certification programs to transform cocoa farming into a more sustainable and equitable enterprise. Despite the documented benefits, the adoption of certification programs in Nigeria has been slow. Financial constraints remain a significant barrier. Certification requires upfront investments in farm inputs, labour, and compliance audits, which many smallholder farmers cannot afford (Baur et al., 2024). Moreover, the financial risks associated with fluctuating cocoa prices and uncertain premium payments deter farmers from committing to certification schemes.

Institutional factors also play a role. The lack of access to extension services and farmer training limits awareness and understanding of certification requirements. Studies have shown that farmers with regular contact with extension agents are more likely to adopt innovations due to better access to information and technical support (Olawale et al., 2021). In addition, the absence

Vol. 09, No. 06; 2024

ISSN: 2456-8643

of strong cooperatives or farmer associations in many Nigerian cocoa communities hinders collective action, which is often necessary for meeting certification standards and negotiating better terms with buyers.

Demographic characteristics further influence certification adoption. Age is a critical factor, with younger farmers generally more willing to adopt new practices compared to their older counterparts, who may be resistant to change (Awoyemi & Salman, 2020). Gender disparities also persist; male farmers are more likely to adopt certification due to greater access to resources such as land and credit, whereas female farmers face systemic barriers that limit their participation (Doss & Morris, 2020). Education, while typically associated with higher adoption rates, has shown mixed results in the Nigerian context. While educated farmers are better equipped to understand the technical aspects of certification, they may also perceive the associated risks more critically, leading to hesitancy (Rogers, 2003).

Therefore, this study investigates the determinants of certification adoption levels among cocoa farmers in Southwest Nigeria, focusing on socio-economic, farm-specific, and institutional factors. By employing an ordered probit regression model, the research categorizes farmers into low, moderate, and high adoption levels, providing a better understanding of the factors influencing their decisions. Unlike previous studies that often take a binary approach to adoption, this study offers a more robust analysis, highlighting the level of adoption and the interplay of influencing socioeconomic factors.

The findings from this research are expected to contribute to the broader discourse on sustainable cocoa farming. Understanding the determinants of certification adoption can guide policymakers, development agencies, and certification bodies in designing targeted interventions. For instance, tailored financial products such as low-interest loans or grants could address the financial barriers to certification. Similarly, strengthening extension services and farmer cooperatives could enhance awareness and support for certification adoption. Furthermore, the study provides a foundation for addressing systemic challenges such as gender disparities and the ageing farming population. By highlighting the roles of demographic factors, the research can inform strategies to engage younger farmers and promote gender-inclusive policies that empower women in cocoa farming. These interventions are critical for ensuring the long-term sustainability of cocoa production in Nigeria, given the increasing global demand for ethically sourced and sustainably produced cocoa.

Objectives of the Study

The primary objective of this study is to examine the determinants of cocoa certification adoption levels among smallholder farmers in Southwest Nigeria. Specifically, the research seeks to:

1. describe the socio-economic characteristics of cocoa farmers and their influence on certification adoption;
2. analyse the factors influencing the level of adoption of cocoa certification adoption in the area; and
3. make policy and practical interventions that can enhance certification adoption and improve the welfare of cocoa farmers.

This study builds on existing research by providing a detailed analysis of certification adoption in the Nigerian context, where limited studies have explored the subject in depth. By integrating recent data and employing robust econometric methods, the research addresses critical gaps in

Vol. 09, No. 06; 2024

ISSN: 2456-8643

the literature. For instance, while prior studies have highlighted the general benefits and barriers of certification, this study delves into the marginal effects of specific factors on adoption levels, offering actionable insights for stakeholders. Moreover, the research aligns with global efforts to promote sustainable cocoa farming. As consumer preferences shift toward ethically sourced products, certification programs are becoming increasingly important for ensuring market competitiveness. By identifying the determinants of adoption, this study contributes to the global discourse on sustainable agriculture and provides a model for other cocoa-producing countries facing similar challenges.

2. MATERIALS AND METHODS

The study was conducted in Southwest Nigeria, a region known for its substantial contribution to Nigeria's cocoa production. This area has a favourable climate for cocoa cultivation and is home to several initiatives aimed at promoting sustainable agricultural practices, including certification programs. The selected states within this region were chosen based on both their high cocoa production capacities and the active presence of Non-Governmental Organizations (NGOs) that support cocoa certification programs, aiming to improve farmers' welfare and sustainable farming practices.

The data for this research were gathered from cocoa farmers in the study area through structured questionnaires and direct interaction with respondents. These data collection efforts were facilitated by the involvement of the State Agricultural Development Programme (SADP) extension workers, who provided essential information for identifying farmers based on their adoption status of certification programs.

A multi-stage sampling procedure was employed to select the study's respondents. In the first stage, two States (Ondo and Osun) in Southwest Nigeria were purposively selected due to their high cocoa production capacities and the presence of NGOs that promote certification programs. This purposive selection ensured the sample represented areas where certification and sustainable practices are actively encouraged. Within each selected state, five Local Government Areas (LGAs) recognized for leading cocoa production were purposively selected. This stage focused on identifying LGAs with a high density of cocoa farmers, while the third stage involved a random selection of four communities from each of the chosen LGAs. The fourth stage involved a simple random sampling approach to select a total of ten respondents from each community. This process culminated in a sample size of 400 respondents, although data from four respondents were excluded due to incomplete information. Consequently, a total of 396 respondents were analyzed in this study. The study employed descriptive statistics and an ordered probit regression model for the objectives.

The Ordered Probit Model: The ordered probit model is an econometric approach that is widely used to analyse more than two outcomes of an ordinal dependent variable. The model was used in this study to address the factors influencing the adoption level of the cocoa certification programme. This is in line with Izik et al. (2009); Oparinde et al. (2018); Tilahun and Tadesse (2022). The model is built around a latent regression just as the binary probit model. Following Greene (2013), the model can be determined by

$$y_i^* = X_i'\beta + \varepsilon$$

where i refers to the observation (i.e., a respondent), y_i^* is a latent unobservable variable that represents the level of financial risk or adoption level of the cocoa certification programme, X_i' is

Vol. 09, No. 06; 2024

ISSN: 2456-8643

a vector of socio-economic and institutional variables of the respondents, β is the unknown parameters to be estimated, and Ɛ is the random error terms assumed to be standard normally distributed.

Since y_i^* is a latent unobservable variable, we observe discrete responses of the variable y_i as follows:

y_i= 0 (low adoption level of cocoa certification programme) if $y_i^* \leq 0$

y_i= 1 (moderate adoption level of cocoa certification programme) if $0 < y_i^* \leq \mu_i$

y_i= 2 (high adoption level of cocoa certification programme) if $\mu_i < y_i^* \leq \mu_2$

The μ_ks are unknown ordered threshold parameters to be estimated with the unknown coefficients β. The probability that the ordered dependent variable y takes the different possible values as

Prob (y= $^0/_X$) = $\emptyset(-X^i\beta)$

Prob (y= $^1/_X$) = $\emptyset(\mu_1 - X^i\beta)$ - $\emptyset(-X^i\beta)$

Prob (y= $^2/_X$) = $\emptyset(\mu_2 - X^i\beta)$ - $\emptyset(\mu_1 - X^i\beta)$

Where, $\emptyset$ indicates a cumulative normal distribution. The cut-off points μ_k divide the categories of the dependent variable. The marginal effect is used to determine the influence of the independent variable per unit change on the dependent variable while everything else is constant. The computation of the marginal effects is meaningful for the ordered probit model because estimated parameter coefficients do not represent the magnitude of the effects of the independent variable on the categories of the dependent variable. Therefore, the marginal effects of change in the regressors are

$$\frac{\partial Prob(y=\frac{0}{X})}{dX} = \emptyset(-X^i\beta)\beta$$

$$\frac{\partial Prob(y=\frac{1}{X})}{dX} = [\emptyset(-X^i\beta) - \emptyset(\mu_1 - X^i\beta)]$$

$$\frac{\partial Prob(y=\frac{0}{X})}{dX} = [\emptyset(\mu_1 - X^i\beta) - \emptyset(\mu_2 - X^i\beta)]$$

However, the description of independent variables that will be used in the ordered probit regression model is follows:

Variable	Description and Measure of the variables
Age	Age of the respondents (years)
Household size	Number of people in the household
Gender of household head	Dummy variable 1 = Male, 0 = Female
Marital Status	Dummy variable 1 = Married, 0 = Otherwise
Education level	Number of years spent in formal education
Farming experience	Number of years in cocoa farming
Farm size	Size of the farm in hectares (ha)
Cocoa farm output	Quantity of cocoa harvested in year (kg)
Non-cocoa farm income	Non –cocoa farm income (Naira)

Vol. 09, No. 06; 2024

ISSN: 2456-8643

Cost of farm labour	Total cost of farm labour (Naira)
Cooperative Member	1, if the respondent is a member of a cocoa cooperative society and 0 otherwise
Financial Risk	1, if the respondent is faced with financial risk, and 0 otherwise
Credit constraints	1= credit constrained, 0 = otherwise.
Interest rate	1, if less than 10 percent and 0 otherwise
Collateral	1, if the respondent has adequate collateral and 0 otherwise
Extension services	1, if the household has access to extension services and 0 otherwise

3. RESULTS AND DISCUSSION

Summary of the Socioeconomic Factors Employed in the Regression

The socioeconomic characteristics of cocoa farmers in the area were analyzed to understand their impact on the adoption of certification programs and overall welfare. As presented in Table 1, about 73.5% of respondents were male, and 26.5% were female, reflecting the labour-intensive and energy-demanding nature of cocoa farming, which is more accessible to men (Adegoroye et al., 2024). Among certification program adopters, 79.5% were male, compared to 20.5% female, aligning with prior studies indicating gender sensitivity in cocoa crop farming (Oseni et al., 2018; Adegoroye et al., 2024). The average age of both adopters and non-adopters was 54 years, indicating an ageing farming population, which may hinder the adoption of innovations due to reduced productivity and economic activity. Similar findings in Nigerian cocoa farming underscore the need for targeted support to sustain future production (Adebiyi & Okunlola, 2013; Olutunmise & Ajibefun, 2019). Educational attainment was relatively high, with 87.6% of respondents having at least primary education, which could positively influence their ability to understand and adopt new technologies. Education is crucial for the adoption of agricultural innovations, supporting informed decision-making (Oparinde and Daramola, 2014; Olorunfemi et al., 2020). The majority (81.3%) of respondents were married, suggesting a level of stability and maturity conducive to making joint decisions with spouses, which can enhance productivity through family labour contributions. This is consistent with findings that married individuals often engage in diverse economic activities to support family needs (Bassey et al., 2015). The average household size was seven members, with 80% having between 4 and 9 members, providing a labour pool advantageous for rural agricultural activities. Larger household sizes have been associated with a greater willingness to adopt labour-intensive practices (Rogers, 2003). The mean farming experience was 33 years, with 63.9% of respondents having between 21 and 40 years of experience. Extensive farming experience can contribute positively to the adoption of new practices, as it correlates with increased skills and knowledge (Olorunfemi et al., 2020). Most respondents (61.6%) owned between 4 to 6 hectares, classifying them as small to medium-scale farmers, a factor influenced by limited mechanization and land tenure issues (Adisa & Adeloye, 2012).

Vol. 09, No. 06; 2024

ISSN: 2456-8643

Table 1: Results of the Summary Statistics of the Variables

Variables	Adopters		Non-Adopters		Pooled	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Gender						
Female	41	20.5	63	32.1	105	26.5
Male	159	79.5	133	67.9	291	73.5
Age (years)						
≤30	3	1.5	1	.5	4	1.0
31-60	153	76.5	144	73.5	297	75.0
61-90	42	21.0	51	26.0	93	23.5
>90	2	1.0	0	0.0	2	.5
Education						
No Formal Education	25	12.5	24	12.2	49	12.4
primary Education	65	32.5	59	30.1	125	31.6
Secondary Education	66	33.0	71	36.2	136	34.3
Tertiary Education	44	22.0	42	21.4	86	21.7
Marital status						
Single	6	3.0	2	1.0	8	2.0
Married	170	85.0	153	78.1	322	81.3
Divorced	0	0.0	1	.5	1	.3
Widowed	24	12.0	36	18.4	61	15.4
Widower	0	0.0	4	2.0	4	1.0
Household size						
≤3	8	4.0	8	4.1	16	4.0
4-6	82	41.0	97	49.5	179	45.2
7-9	81	40.5	57	29.1	138	34.8
10-12	26	13.0	32	16.3	58	14.6
13-15	3	1.5	1	.5	4	1.0
>15	0	0.0	1	.5	1	.3
Experience						
≤10	7	3.5	7	3.6	14	3.5
11-20	28	14.0	20	10.2	48	12.1
21-30	72	36.0	73	37.2	146	36.9
31-40	58	29.0	50	25.5	107	27.0
41-50	31	15.5	33	16.8	64	16.2
>50	4	2.0	13	6.6	17	4.3
Farm Size						
≤3	63	31.5	63	32.1	127	32.1
4-6	119	59.5	126	64.3	244	61.6
>6	18	9.0	7	3.6	25	6.3

Vol. 09, No. 06; 2024

ISSN: 2456-8643

Total	200	100.00	196	100.00	396	100.00

Factors Influencing the Adoption Level of the Cocoa Certification Programme

Table 2 shows the results of the marginal effect of factors that determine the adoption level of cocoa certification programmes in the study area. The ordered probit regression model used in this study demonstrates a statistically significant fit to the data, as evidenced by multiple diagnostic parameters. The model's log-likelihood is reported at -415.302, which indicates the probability of observing the sample data given the estimated coefficients. The significant Likelihood Ratio (LR) Chi-square statistic of 32.02, provides strong evidence against the null hypothesis that all regression coefficients are zero. This significant Chi-square result implies that the independent variables collectively contribute explanatory power to the model, affirming the relevance of the selected predictors for explaining variations in certification adoption levels. The threshold (cut) points, presented as Cut 1 = -1.298 and Cut 2 = 6.992, define the boundaries between the observed categories of certification adoption levels (low, moderate, high). These cut points allow the ordered probit model to categorize the continuous latent variable into the observed ordered outcomes. These cut points are essential for interpreting the model's predictions, providing clear segmentation across adoption levels without testing statistical significance, as they serve as boundaries rather than parameter estimates. Therefore, fifteen explanatory variables were employed in the model out of which eleven were statistically significant at different levels. The statistically significant variables were: age, household size, gender, education, farming experience, farm size, non-cocoa farm income, financial risk, credit constraint, collateral and access to extension agents.

Age: The coefficient for age is negative and highly significant at the 1% level across all adoption levels, indicating that as farmers' age increases, their likelihood of falling into higher adoption categories (moderate or high) decreases. This trend suggests that older farmers may exhibit lower interest or willingness to adopt certification programs, possibly due to a preference for established methods or perceived risks in changing practices. This finding aligns with Awoyemi and Salman (2011) and Isaac et al. (2020), who found that younger individuals are generally more receptive to technological innovations and more adaptable to new practices.

Household Size: Household size has a positive and statistically significant effect at the 5% level across all adoption categories, indicating that larger households are associated with higher adoption levels. The availability of additional family labour may facilitate the adoption of certification programs, as larger households can allocate more labour to meet the demands of certified cocoa farming practices. This finding supports the work of Doss and Morris (2020), who observed that larger household sizes positively influence the adoption of agricultural innovations due to the labour advantages they offer.

Gender: Gender is positively correlated with adoption levels and is highly significant at the 1% level, indicating that male farmers are more likely to adopt certification programs at higher levels than female farmers. This outcome may reflect gender-based differences in resource access, where men often have greater control over land, finances, and other critical inputs, enhancing their capacity for adoption. Doss and Morris (2020) similarly found that male farmers generally have better access to agricultural inputs and extension services, contributing to higher adoption rates.

Vol. 09, No. 06; 2024

ISSN: 2456-8643

Education: The relationship between education and adoption levels is negative but statistically significant at the 5% level across all categories. This finding contrasts with conventional expectations that education increases the likelihood of adoption, suggesting that more educated farmers may be more critical or selective in evaluating certification programs. Rogers (2003) noted that individuals with higher education levels may exercise caution in adopting new technologies due to their ability to critically assess associated risks, although this contrasts with studies like Asfaw and Admassie (2004), who found education to positively influence innovation adoption.

Farming Experience: Experience has a negative effect on adoption and is statistically significant at the 5% level, indicating that more experienced farmers are less likely to adopt certification programs at higher levels. This trend suggests that experienced farmers may rely on traditional practices that have proven effective over time, making them less willing to adopt new methods. This finding is consistent with Foster and Rosenzweig (2010), who reported that experienced farmers are often less receptive to adopting innovations due to a preference for familiar practices.

Farm Size: The coefficient for farm size is negative and marginally significant at the 10% level across all categories, suggesting that larger farm sizes are associated with a lower probability of high-level certification adoption. This result may reflect logistical or financial constraints, as implementing certification requirements on a larger scale can be challenging and costly. Marra et al. (2003) found that farmers with larger landholdings may hesitate to adopt innovations due to the complexities and increased costs associated with scaling practices across extensive areas.

Non-Cocoa Farm Income: Non-cocoa farm income exhibits a positive and significant effect at the 1% level across all categories, indicating that additional income from non-cocoa activities increases the likelihood of certification adoption. This finding suggests that diversified income sources provide financial stability, enabling farmers to invest more readily in certification programs. Adebayo and Adeola (2008) similarly noted that income diversification supports farmers in adopting new agricultural technologies by reducing financial constraints and risk.

Financial Risk: The coefficients for financial risk are negative and statistically significant at the 1% level, indicating that higher financial risk decreases the likelihood of adopting certification programs at higher levels. This result suggests that cocoa farmers facing greater financial uncertainty are less inclined to assume additional risks associated with certification adoption. Contrary to this finding, Baur et al. (2024) argued that risk aversion may sometimes encourage adoption if innovations promise long-term stability; however, this effect may vary depending on the context and perceived benefits of the innovation.

Credit Constraints: Credit constraints are positively associated with adoption at the 10% significance level, implying that farmers facing credit limitations may adopt certification programs as a coping mechanism to improve their economic stability. This outcome is consistent with Seck (2021), who found that farmers with limited access to credit often turn to innovative practices to enhance productivity and income, thus mitigating financial challenges.

Collateral and Extension Services: Both collateral and extension services are positively and highly significant at the 1% level across all adoption levels. Access to collateral provides financial security, allowing farmers to invest in certification adoption with greater confidence. Similarly, access to extension services enhances adoption by offering technical support and information on certification practices. These findings align with studies by Fischer and Qaim (2012) and Oni and Oladele (2012), who observed that cooperatives, credit access, and extension

Vol. 09, No. 06; 2024

ISSN: 2456-8643

services play crucial roles in improving adoption rates by providing resources, knowledge, and risk mitigation.

Table 2: Determinants of the Adoption Level of Certification Programme using the Marginal Effect of Ordered Probit Regression

Variables	Low		Moderate		High	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
Age	-0.001***	0.000	-0.001***	0.000	-0.001***	0.000
Household size	0.005**	0.011	0.005**	0.011	0.004**	0.011
Gender	0.047***	0.000	0.046***	0.000	0.044***	0.000
Marital status	-0.016	0.642	-0.016	0.642	-0.015	0.642
Education	-0.002**	0.035	-0.002**	0.035	-0.002**	0.035
Experience	-0.001**	0.041	-0.001**	0.041	-0.001**	0.040
Farm size	-0.093*	0.079	-0.090*	0.079	-0.087*	0.077
Output	-2.07e-5	0.324	-2.02e-5	0.324	-1.94e-5	0.324
Non-cocoa farm income	7.29e-8***	0.001	7.11e-8***	0.001	6.83e-8***	0.001
Other occupation	0.046	0.326	0.045	0.325	0.043	0.325
Financial risk	-0.201***	0.001	-0.196***	0.001	-0.189***	0.001
Credit constraints	0.005*	0.065	0.005*	0.065	0.005*	0.066
Interest rate	0.006	0.899	0.006	0.899	0.005	0.899
Collateral	0.081***	0.000	0.079***	0.000	0.076***	0.000
Extension	0.148***	0.003	0.145***	0.002	0.139***	0.002
cut 1	-1.298	0.622				
cut 2	6.992	0.622				
Observations	200					

Log likelihood= -415.302; LR chi2 (15) = 32.02; Prob > chi2c = 0.0064; Pseudo R2 = 0.0371.
Note: *, **, *** means significance at 10%, 5% and 1%, respectively

4. CONCLUSION AND RECOMMENDATIONS

This study examined the determinants of adoption levels of cocoa certification programmes among smallholder farmers in Southwest Nigeria, using an ordered probit regression model to analyze the factors influencing the level of adoption. The findings highlight that socio-economic, demographic, and institutional factors significantly affect farmers' likelihood of adopting certification programs at various levels. Key variables such as age, gender, education, household size, farming experience, farm size, financial risk, non-cocoa farm income, access to credit, collateral, and extension services were found to play critical roles in shaping adoption decisions. The analysis reveals that younger farmers and those with larger households are more likely to adopt certification programs at higher levels, benefiting from greater adaptability and available family labour. Conversely, older and more experienced farmers are less inclined to adopt,

Vol. 09, No. 06; 2024

ISSN: 2456-8643

possibly due to entrenched reliance on traditional farming methods. Gender disparities in adoption remain pronounced, with male farmers more likely to participate in certification programs due to better access to resources and decision-making power. Additionally, financial constraints, including high perceived financial risks and limited credit access, pose significant barriers to adoption. However, access to extension services and the availability of collateral positively influence farmers' capacity to meet certification requirements.

While certification programs offer significant potential to improve farmer welfare, food security, and environmental sustainability, their current adoption rates in Nigeria remain suboptimal. Addressing the identified barriers requires targeted interventions, such as enhancing access to affordable credit, providing subsidies for certification costs, and strengthening extension services to improve farmer awareness and technical capacity. Moreover, fostering gender-inclusive policies and supporting cooperative structures could enhance the participation of underrepresented groups, particularly women. Based on these major findings, the government should establish dedicated low-interest loan schemes or grants specifically tailored for cocoa farmers to cover certification costs and initial investments. They can also partner with microfinance institutions and cooperatives to provide accessible financial services, including savings and credit products. Also, introduce government or NGO-led subsidy programs to offset the costs of certification audits, training, and compliance for smallholder farmers. Tax incentives or reduced fees for certified farmers should be provided to encourage participation. The government should increase the availability of agricultural extension officers trained in certification program requirements. This could be achieved by developing mobile-based platforms to disseminate information, technical support, and real-time updates about certification processes. Encourage and support farmers in engaging in supplementary income-generating activities, such as crop diversification or agro-processing, to reduce dependency on cocoa income. This can be done by offering training and resources for value-added activities, such as cocoa butter or powder production.

REFERENCES

Adebayo, K., & Adeola, R. G. (2008). Sources and utilization of information in the adoption of improved agricultural technologies in Akinyele Local Government Area of Oyo State. *Journal of Human Ecology, 20*(4), 313–316. https://doi.org/10.1080/09709274.2006.11905931.

Adebiyi, S., & Okunlola, J. O. (2013). Factors affecting adoption of cocoa farm rehabilitation techniques in Oyo State of Nigeria. *World Journal of Agricultural Sciences, 9*(3), 258–265.

Adegoroye, A., Oluwalade, T. A., Adeyelu, A. A., Olorunfemi, O. A., & Mope, C. (2024). Impacts of Farm Business School (FBS) intervention on the income of the cocoa farmers in Nigeria. *Asian Journal of Agricultural and Horticultural Research, 11*(1), 44–57.

Adisa, B. O., & Adeloye, K. A. (2012). Analysis of farmer field school as an extension approach to cocoa production in Osun State, Nigeria. *World Journal of Agricultural Sciences*, *8*(4), 421-428.

Akinbola, A. E. (2023). Effect of credit services and socioeconomic factors on the income of cocoa marketers in Ondo State, Nigeria.

Vol. 09, No. 06; 2024

ISSN: 2456-8643

Akinrotimi, A. F. (2024). Gender-based differentials in cocoa bean production in Ondo State, Nigeria. *Ondo University Journal of Agriculture and Social Sciences, 2*(1), 1–8.

Akinrotimi, A. F., Thompson, O. A., & Arifalo, S. F. (2024). Assessing Good Post-Harvest Practices and Barriers among Cocoa Farmers and Licensed Buying Agents in Southwest, Nigeria. *Asian Journal of Research in Agriculture and Forestry*, *10*(3), 60–74. https://doi.org/10.9734/ajraf/2024/v10i3300

Akinwale, T. O., Olajide, A. F., & Ibitoye, D. (2022). Certification and welfare outcomes for cocoa farmers in Nigeria. *International Journal of Agricultural Policy, 11*(2), 121–135.

Akinwale, T. O., Olajide, A. F., & Ibitoye, D. (2022). Sustainability of cocoa production in Nigeria. *International Journal of Agricultural Economics and Development, 8*(11), 45–58.

Asante, E. B., Quartey, P., & Acheampong, P. (2021). Fairtrade certification and its impact on cocoa farmers in Ghana. *Journal of Agricultural Development and Economics, 56*(3), 23–35.

Asfaw, S., Shiferaw, B., & Simtowe, F. (2012). The endogenous switching regression model and its application to the determinants of adoption of improved natural resources management practices by farmers in Ethiopia. *Journal of Agricultural Economics, 63*(2), 321–339. https://doi.org/10.1111/j.1477-9552.2011.00353.

Awoyemi, A. O., & Aderinoye-Abdulwahab, S. A. (2020). Assessment of the use of cocoa production management practices among cocoa farmers in Ekiti State, Nigeria. *Journal of Tropical Agriculture, Food, Environment and Extension*, *18*(2), 37–41.

Awoyemi, T. T., & Salman, K. K. (2020). Socioeconomic factors influencing adoption of agricultural innovations among smallholder farmers in Nigeria. *African Journal of Agricultural Research, 15*(2), 341–350.

Barham, B. L., & Weber, J. G. (2020). The economic sustainability of certification schemes for smallholder farmers. *World Development, 138*, 105234. https://doi.org/10.1016/j.worlddev.2020.105234.

Barham, B. L., & Weber, J. G. (2012). The economic sustainability of certified coffee: Recent evidence from Mexico and Peru. *World Development, 40*(6), 1269–1279.

Bassey, B. E. (2015). Transforming the Nigeria tourism industry through tourism entrepreneurial development. *African Journal of Business Management*, *9*(15), 569-580.

Baur, P., Getz, C., Petersen-Rockney, M., & Sowerwine, J. (2024). Compliance is far from standard: Relational conditions of access and exclusion in agriculture. *Journal of Rural Studies*, *109*, 103335.

Doss, C. R., & Morris, M. L. (2020). Gender and innovation in agricultural development. *Agricultural Economics, 49*(3), 259–272.

FAOSTAT. (2021). Cocoa production statistics in Nigeria. Food and Agriculture Organization. Retrieved from https://www.fao.org.

Fischer, E., & Qaim, M. (2012). Linking smallholders to markets: Determinants and impacts of farmer collective action in Kenya. *World Development, 40*(6), 1255–1268. https://doi.org/10.1016/j.worlddev.2011.11.018.

Foster, A. D., & Rosenzweig, M. R. (2010). Microeconomics of technology adoption. *Annu. Rev. Econ.*, *2*(1), 395-424.

Vol. 09, No. 06; 2024

ISSN: 2456-8643

Green, W. H. (2000). Econometric estimation of count data models: Some recent developments. In R. C. Mittelhammer, C. F. Spillman, & K. F. Kosa (Eds.), *Contributions to economic analysis, volume 243: Statistical methods in agriculture and experimental biology* (pp. 165–181). Amsterdam: Elsevier Science.

International Cocoa Organization (ICCO). (2020). *Cocoa statistics.* Retrieved from https://www.icco.org.

Isaac, O. A., Comfort, A. I., Igbekele, A. A., & Timothy, A. T. (2020). Adoption of improved technologies and profitability of the catfish processors in Ondo State, Nigeria: A Cragg's double-hurdle model approach. *Scientific African*, *10*, e00576.

Izik, D., Bar-Shira, Z., & Blinder, A. (2009). Incorporating ordered response into customer satisfaction surveys: An application to mobile phone users. *Journal of the Royal Statistical Society: Series A (Statistics in Society), 172*(1), 167–188. https://doi.org/10.1111/j.1467-985X.2008.00559.

Kouadio, L. A., N'Guessan, K., & Soro, D. (2022). Rainforest Alliance certification and its effects on cocoa productivity in Côte d'Ivoire. *Journal of Sustainable Agriculture*, *45*(1), 102–118.

Marra, M., Pannell, D. J., & Ghadim, A. A. (2003). The economics of risk, uncertainty and learning in the adoption of new agricultural technologies: where are we on the learning curve?. *Agricultural systems*, *75*(2-3), 215-234.

Olawale, T., Adekunle, S., & Ibrahim, M. (2021). Barriers to cocoa certification in Nigeria: Evidence from smallholder farmers. *Agricultural Finance Review, 81*(2), 234–250.

Olorunfemi, T. O., Olorunfemi, O. D., & Oladele, O. I. (2020). Determinants of the involvement of extension agents in disseminating climate smart agricultural initiatives: Implication for scaling up. *Journal of the Saudi Society of Agricultural Sciences*, *19*(4), 285-292.

Olutumise, A. I., & Ajibefun, I. A. (2019). Evaluation of poverty status and time-taken to exit poverty among food crop farmers in Nigeria. *Journal of Agricultural Faculty of Gaziosmanpaşa University (JAFAG), 36*(2), 97–106.

Olutumise, A. I., Oparinde, L. O., & Simon-Oke, O. O. (2019). Assessment of income inequality, structure, and conduct of cocoa marketers in Osun State, Nigeria. *Journal of Scientific Research and Reports*, *25*(6), 1–12.

Oni, O. A., & Oladele, O. I. (2012). Impact of farmers' cooperative membership on food security and income in Southwest Nigeria. *Journal of Human Ecology*, *38*(1), 113–119. https://doi.org/10.1080/09709274.2012.11906492.

Oparinde, L. O., & Daramola, A. G. (2014). Determinants of market participation by maize farmers in Ondo State, Nigeria. *Journal of Economics and Sustainable Development*, *5*(1), 69-77.

Oparinde, L. O., Amos, T. T., Aturamu, O. A., & Daramola, A. G. (2018). Attitudes towards risk and risk combating strategies among maize and cassava farmers in Southwest, Nigeria. *Journal of Economics, Management and Trade*, *21*(7), 1-12.

Oparinde, L. O. (2019). Fish output and food security under risk management strategies among women aquaculture farmers in Ondo State, Nigeria. *AGRIS on-line Papers in Economics and Informatics*, *11*(1), 93-105.

Oseni, J. O., Olutumise, A. I., & Olutumise, B. O. (2018). Performance evaluation of cocoa marketing in Osun State, Nigeria. *Jurnal Perspektif Pembiayaan dan Pembangunan Daerah, 6*(1), 97–112.

Vol. 09, No. 06; 2024

ISSN: 2456-8643

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Seck, A. (2021). Heterogeneous credit constraints and smallholder farming productivity in the Senegal River Valley. *Emerging Markets Finance and Trade*, *57*(12), 3301-3319.

Tilahun, Y., & Tadesse, B. (2022). Determinants of households' willingness to pay for improved teff seed in Yilmana-Dinsa Woreda, Northern Ethiopia. *Cogent social sciences*, *8*(1), 2029248.

Trujillo-Barrera, A., Pennings, J. M. E., & Hofenk, D. (2020). Understanding the adoption of sustainability certification programs: Insights from cocoa farmers. *Journal of Agricultural Economics*, *71*(3), 680–703.