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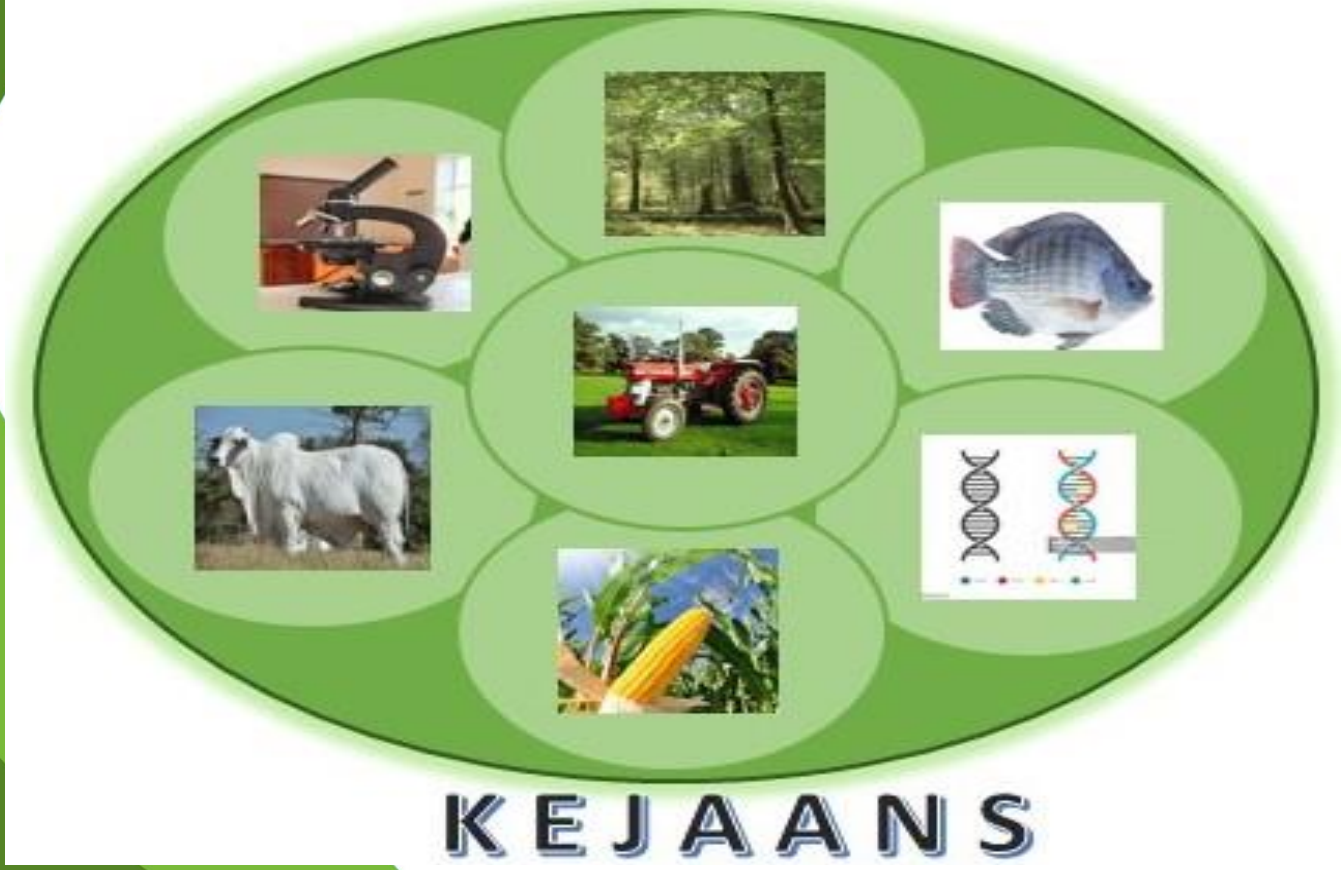

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ACCESS AND UTILIZATION OF IMPROVED COCOA PRODUCTION TECHNOLOGIES BY RURAL HOUSEHOLDS IN CROSS RIVER STATE, NIGERIA

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ABSTRACT
The study analyzed access and utilization of improved cocoa production technologies by rural households in Cross River State, Nigeria. Multi-stage and purposive sampling techniques were used to collect data for the study. A total of 120 rural households who have utilized improved cocoa production technologies were used as sample size. Data were collected from primary source using structured questionnaire and FGD and analyzed using both descriptive and inferential statistics, such as frequency distribution, percentages, mean and regression model. There was both high level of access to (grand mean =3.18) and high level of utilization (grand mean = 3.38) of the improved cocoa production technologies. Control of black pod disease with fungicides ($\bar{x}$=3.91), Fermentation and drying of cocoa pods ($\bar{x}$= 3.84) and Control of Capsids with insecticides ($\bar{x}$= 3.63) were amongst those technologies that were highly accessed and utilized in the study area. The multiple regression test on the relationship between the socio-economic characteristics of the members of rural households and their utilization of Improved cocoa production technologies in the study area showed that marital status (2.771***), Farm Size (5.071***), Educational status (2.799***), Extension contacts (2.670**) amongst others were positively significant. The study concluded that there is high level of access and utilization of the improved cocoa production technologies by rural households in the study area and therefore recommends that the technology on improved seedlings should be made more available and accessible by technology developers at a reduced cost to enhance its utilization for increased production.

Keywords**:** Access; Utilization; Improved cocoa production technologies; Cross River State

Introduction

Among Nigeria's primary agricultural export is cocoa, contributing 0.3% to the country's agricultural GDP and in the first quarter of 2022, Nigeria's earnings from its export accounted for around 41.6% of its foreign exchange earnings from raw cocoa beans, amounting to N122.9 billion (Agency Report, 2022).

Cocoa is widely cultivated in the southern belt of Nigeria owing to the soil and climatic condition prevailing in the area. This includes Abia, Adamawa, Akwa Ibom, Cross River, Delta, Edo, Ekiti, Kogi, Kwara, Ogun, Ondo, Osun, Oyo, and Taraba. In terms of capacity, Ondo State is rated as the largest cocoa producing state in Nigeria (Afolayan, 2020). Cocoa is an import agricultural export crop in Nigeria with Nigeria producing about 5% of total world production (FAO, 2013).

Olowolaju (2014) asserts that cocoa is a significant supply of raw materials and a

source of income for the governments of the States that produce cocoa. As the biggest source of non-foreign exchange earnings in Nigeria, cocoa employs millions of Nigerians as growers, processors, licensed buying agents, marketers, and exporters, contributing significantly to their household income. Additionally, cash crops have made significant contributions to the nation's GDP through high foreign exchange rates, rural economic growth, and increased farmer income in the fight against poverty (Fountain and Huetz-Adams, 2018).

But the cocoa sub-sector saw a downturn when the oil boom of the 1970s arrived. Olaiya (2016) suggested that the oil boom syndrome in conjunction with other socioeconomic reasons was the reason behind the decrease in cocoa production.

Cocoa Research Institute of Nigeria (CRIN) released eight new cocoa hybrids through Agricultural Transformation Agenda (ATA) giving out 1.4 million cocoa pods to farmers in cocoa producing states in the country in addition to provision of inputs such as fertilizers, insecticides and fungicides at a subsidized rate to the farmers (CRIN Publication, 2016). According to Adesiyan, Adesiyan, and Agbonlahor (2019), CRIN released eight new cocoa hybrids through the Agricultural Transformation Agenda (ATA), providing farmers in the nation's cocoa-producing States with 1.4 million cocoa pods in addition to inputs like fertilizers, fungicides, and insecticides at a subsidized rate to the farmers. This is because cocoa is one of the capital-intensive businesses especially when it comes to the purchase of improved seedlings.

Furthermore, Essiet (2018) agreed that utilization of improved production practices by farmers leads to improved yield of crops; also, that the productivity and the quality of cocoa depend on the use of improved technology and with the help of better agricultural practices and post- harvest techniques, the quality of cocoa would increase and the yields would be higher.

Equally, Ajayi and Adeoti (2019) in research found out that the utilization of new agricultural technology that could lead to a significant increase in agricultural production and productivity can be realized when yield increasing technologies are widely used and diffused. Hence it becomes pertinent to analyze empirically, the level of rural households' access and utilization of improved cocoa production technologies in Cross River State. Nigeria. Specifically, the objectives of the study were to: describe the socio-economic characteristics of the rural households in the study area; ascertain the level of access to improved cocoa production technologies by rural households; and determine the rural households' level of utilization of improved cocoa production technologies in the study area.

Methodology

Study Area

The study was carried out in Cross River Nigeria. Cross River State is one of six States in the South-South geopolitical zone of Nigeria. The average temperature of the state is between 15°C and 30°C. However, this climatic condition is different in locations within the Cross River state such as the high plateau of Obudu, which has a record of a fall in temperature between 4°C and 10°C, as a result of the high altitude of this area. The capital city of the State, Calabar, has a significant record of rainfall within the year, while the dry season has less significant effect in the state due to the depth of rainfall experienced. Based on the records presented by the Climate Data of the state, the annual rainfall of Cross River State is 3306mm (130.2 inches) (Cross River State Government (2024).

Sample Size and Sampling Procedure

A multistage sampling procedure was employed to select the sample for the study. It employed purposive sampling in selecting three (3) Local Government Areas (LGAs) in the first instance depending on the level of cocoa farming in the area. These L.G. As were Boki, Etung and Ikom. In the second stage, four (4) communities were equally purposively selected from each LGA, bringing the total number to twelve (12) communities. These communities were: – Boki LGA (Bashua, Abonorok, Oriemekpung and kanyang), Etung LGA (Benedeghe, Abia, Benedeghe farm and Agbokim) and Ikom LGA (Ekparabong, Ikom, Nde,and Okuni).

Continuing, 10 rural households were purposively selected from each of the communities to give rise to a total of 120 cocoa rural households that were used for the study.

Measurement of variables

Objective i: identify the socio-economic characteristics of rural households. The socio-economic characteristics described were:

Age of the member of rural household was measured in years

Sex: (Male = 1, Female = 0)

Marital Status: (married = 1, otherwise = 0)

Farm size: (measured in hectares)

Level of Education: (No of years spent in school)

Household Size: (No. of people living in the same house and eating from the same pot)

Occupation: (Farming = 1, others = 0)

Annual income: (in naira)

Membership participation in cooperative organization: (Always=3, Sometimes= 2, Never = 1)

Farming experience: (in years)

Extension Contact: (once a week=3, fortnightly =2, bi-monthly = 1, monthly = 2, none at all =1)

Objective ii, rural households' access to improved cocoa production technologies was realized using a 4-point rating scale namely: Always = 4, Sometimes = 3, Rarely =2, Never = 1. The bench mark was obtained thus: 4+3+2+1 = 10, divided by 4 to give 2.50. This implies that any mean score responses below the benchmark mean (less than 2.50) was adjudged to be low level of access of improved cocoa production technology while from 2.50 – 2.99 was said to be moderate level of access and from 3.00 and above (≥ 3.00) was adjudged high level of access of improved cocoa production technologies.

In order to achieve **Objective iii** which is to ascertain rural households' level of utilization of improved cocoa production technologies was captured using a 4-point rating scale namely: Always = 4, Sometimes = 3, Rarely = 2, Never = 1. The bench mark was obtained thus: 4+3+2+1 = 10, divided by 4 to give 2.50. This implies that any mean score responses below the benchmark mean (less than 2.50) was adjudged to be low level of utilization of improved cocoa production technologies while from 2.50 – 2.99 was said to be moderate level of utilization and from 3.00 and above (≥ 3.00) was adjudged high level of utilization of improved cocoa production technologies.

Results and Discussion

Socio-Economic Characteristics of Rural Households

The result of the socioeconomic characteristics of rural households involved in the utilization of improved cocoa production technologies in Cross River State is presented in Table 1.

Table 1: Percentage Distribution of Rural Households Based on their Socio-economic Characteristics

Variables	(n=120)	Variables	(n=120)
Age		**Household Size**	
≤30	12(10.0)	1 – 6	102(85.0)
31 – 40	20(16.7)	≥7	18(15.0)
41 – 50	36(30.0)	**Mean**	**4**
51 – 60	32(26.6)	**Major Occupation**	
≥61	20(16.7)	Farming	85(70.8)
Mean	**49**	Civil Service	4(3.3)
Sex		Trading	20(16.7)
Male	90(75.0)	Artisan	11(9.2)
Female	30(25.0)	**Membership of Cooperatives and Participation**	
Marital Status		Always	57(47.5)
Married	93(77.5)	Sometimes	56(46.7)
Single	27(22.5)	Rarely	4(3.3)
Farm Size (ha)		Never	3(2.5)
1 – 5	68(56.7)	**Years of Experience**	
6 – 10	31(25.8)	1 – 10	46(38.3)
11 – 15	18(15.0)	11 – 20	57(47.5)
≥16	3(2.5)	21 – 30	11(9.2)
Mean	**6ha**	≥31	6(5.0)
Level of Education		**Mean**	**14.2**
No formal Education	1(0.8)	**Contact with Extension**	
Primary School uncompleted	3(2.5)	Once a week	30(25.0)
Primary School completed	10(8.3)	Fortnightly	7(5.8)
Secondary School Uncompleted	18(15.0)	Bi-monthly	11(9.2)
Secondary School Completed	62(51.7)	Monthly	38(31.7)
Tertiary Institution Attended	26(21.7)	None at all	34(28.3)

Source: Field Survey Data, 2024; the Figures in parenthesis are the percentages

The result showed that in the study area, the mean age of the members of the rural households was 49 which implied that majority of the members were middle aged persons in their productive years. Their energies could be harnessed and utilized for cocoa production activities. This finding corroborates that of Ukoha and Okonkwo (2017) that most rural household members in the study area are middle aged persons who are still very active in carrying out farm activities. In addition, Osarenren, Ejuetueyin and Eweka (2016) found out that the mean age of cocoa farmers in South South zone of Nigeria was 46 years.

The result also showed that, majority (75.0%) of the members were males while 25.0% were females. This implies that more male members of the households are involved in cocoa production than their female counterparts in study area. Furthermore, greater participation of men in cocoa farming could be attributed to the highly intensive labour requirement involved in cocoa farming which the male gender could afford. Females were mostly involved as helpers and suppliers of labour in some meager aspect of the business, such as weeding, processing and some marketing operations. The findings collaborate that of Ogunsola, Oseni and Bankole (2020) that stated that 94% of the farmers were males while 6% were female cocoa farmers thereby attributing it to the fact that women are mostly involved in post-harvest activities like breaking of pods and drying of cocoa beans. Osarenren, Ejuetueyin and Eweka (2016) findings also agreed that in cocoa production, the role of the women is often confined to post harvesting handling which includes fermentation and drying

Furthermore, majority (77.5%) of the household members were married while 22.5% were single. This further agreed with the findings of Osarenren, Ejuetueyin and Eweka (2016) that most cocoa farmers were mature and could effectively take crucial decisions jointly with their spouses. Wives are still used for supportive operations in the cocoa enterprise.

The mean farm size of cocoa owned by rural households in the study area was 6 ha, implying that the household members involved in cocoa production in the State are mostly small-scaled farmers who operated at near subsistence level of productivity and therefore need larger expanse of land to increase cocoa production. This finding agreed with that of Ogunsola, Oseni and Bankole (2020) that observed that mean farm size of the cocoa farmers studied was 6.62 hectares.

The results on the level of education of the members of rural households involved in cocoa production indicated that there was an appreciable level of literacy as over 90% of the members of the households attained one level of formal education or the other in the area, which of course aided the utilization of the improved cocoa production technologies by the farmers. This finding could be attributed to the level of enlightenment and exposure from the colonial era where Calabar the State Capital was the base of the colonial masters that brought in formal education in Nigeria.

The result is in agreement with the findings of Nwaobiala (2014) that level of education aids in supporting the acceptability and utilization of technologies through exchange of information. It is also in tandem with that of Ifenkwe and Izuogu (2015) that education and training enhance farmers' productivity and innovativeness. Ukoha and Nzeakor (2020) findings equally agreed that the extent of education received by farmers goes a long way in assisting them to utilize improved technologies.

Results of the household size of the rural households involved in cocoa production showed that the mean household size was 4 persons while majority (70.8%) of the farmers have Farming as their major occupation. This result agreed with the findings of Ogunsola, Oseni and Bankole (2020) that 75% of the total cocoa farmers studied have no other primary occupation apart from farming.

The result of the percentage distribution of the rural households' membership of Cooperatives and participation showed that majority (over 95%) of the members participated in the Cooperative activities. Active participation in Cooperative activities no doubt impact positively on productivity. This finding is in contrast to that of Kanu (2020) that majority of

the cocoa farmers (84.44%) do not belong to any cooperative society. Nmeregini, Onuekwusi and Ekweanya (2020) opined that membership to cooperative will positively influence the participation of farmers in agricultural activities.

The results on the members of the rural households' farming experience indicated that the mean years of farming experience of the rural households was 14.2 years. This indicated that the rural households in the study area have long been engaged in cocoa farming activities, some of the members were into it. Farming experience is an important factor determining both the productivity and the production level in farming. The farming experience of cocoa farmers is expected to have a positive impact on their production level (Ogunsola, Oseni and Bankole, 2020).

On Extension Contacts, the results as presented in Table 1 showed that majority (71.7%) of the rural households in the study area, had contacts with extension either bi-monthly, monthly, fortnightly or even on weekly basis. This finding collaborates that of Anyanwu, Ukoha and Okezie (2021) that over 80% of the farmers studied have good contact with extension agents showing an appreciable level of extension contact among the farmers. Nevertheless, the absence of extension contact or low extension contact will negatively affect technology utilization among other extension services (Ukoha, Agu-Aguiyi, and Onwukwe, 2020).

Level of Access to Improved Cocoa Production Technologies

Result of the level of access to improved cocoa production technologies as presented in Table 2.

Table 2: Distribution of Rural households based on Level of Access to Improved Cocoa Production Technologies

Improved Cocoa Technologies	$\sum fx$	$\bar{x}$	**Rank**	**Remark**
Improved Seedlings	344	2.87	7th	Moderate
Weed control (cultural maintenance)	433	3.61	3rd	High
Control of black pod disease with fungicides	467	3.89	1st	High
Fertilizer application	338	2.82	8th	Moderate
Control of capsids with insecticides	416	3.47	4th	High
Weed control with herbicides	302	2.52	9th	Moderate
Fermentation and drying	457	3.81	2nd	High
Complete farm and phased farm replanting	345	2.87	7th	Moderate
Coupon regeneration	382	3.18	5th	High
Coppicing and grafting	352	2.93	6th	Moderate
Grand Mean	**3.18**			**High**

Source: Field Survey Data, 2024

Note: ≤ 2.49 = Low level of Access; 2.50 – 2.99 = Moderate level of Access and ≥ 3.00 = High level of Access

Results showed that improved cocoa production technologies like Control of black pod fungicides had the highest level of access by household members with a mean ($\bar{x}$ = 3.89), the one on Fermentation and drying of cocoa beans ranked 2nd with a mean ($\bar{x}$ = 3.81), weed control (cultural maintenance) came 3rd with a mean ($\bar{x}$ = 3.61) while fertilizer application ($\bar{x}$

= 3.48) took the 4th highest position in the ranking order of the level of access of farmers to improved cocoa production technology. Other improved cocoa production technologies such as Control of capsids ($\bar{x}$ = 3.47), Complete Farm and phased farm replanting ($\bar{x}$ = 3.46), coupon regeneration (3.18), weed control with herbicides (3.08) and Improved seedlings ($\bar{x}$ = 3.18) came 5th, 6th, 7th, 8th and 9th positions respectively in ranking of technologies that were highly accessed by the cocoa farmers. The technology on Coppicing and grafting ($\bar{x}$ = 2.93) and Improved Seedlings were moderately accessed, taking the 9th and 10th positions on the ranking Table. None of the technologies had low access by rural households in the study area. This could be attributed to the level of awareness and enlightenment in the area.

However, the improved cocoa production technologies on Coupon regeneration and coppicing and grafting cocoa trees recorded low level access with mean scores of 2.49 and 1.96 respectively. This could be attributed to the fact that coppicing is mainly carried out when a cocoa tree is diseased and old. Hence, the technology may only be accessed whenever the need arises. This agrees with the finding of Akinkpelu, Lawal, Ibiremo and Ogunwolu (2021).

The grand mean of 3.18 recorded, showed that there is high level of access of improved cocoa production technologies in the study area. This result is in tandem with the Focus Group Discussion (FGD) result where the rural households in the study area agreed that they have very good access to the improved cocoa production technologies.

Level of Utilization of Improved Cocoa Production Technologies

The results on the level of utilization of improved cocoa production technologies in the study area is presented in Table 3.

Table 3: Distribution of Cocoa farmers based on Level of Utilization of Improved Cocoa Production Technologies

Improved Cocoa Technologies	$\sum fx$	$\bar{x}$	**Rank**	**Remark**
Improved Seedlings	315	2.63	10th	Moderate
Weed control (cultural maintenance)	422	3.51	5th	High
Control of black pod disease with fungicides	469	3.91	1st	High
Fertilizer application	410	3.42	6th	High
Control of capsids with insecticides	438	3.65	3rd	High
Weed control with herbicides	373	3.11	8th	High
Fermentation and drying	459	3.83	2nd	High
Complete farm and phased farm replanting	427	3.56	4th	High
Coupon regeneration	396	3.30	7th	High
Coppicing and grafting	344	2.87	9th	Moderate
Grand Mean		**3.38**		**High**

Source: Field Survey Data, 2024

Note: ≤ 2.49 = Low level of Utilization; 2.50 – 2.99 = Moderate level of Utilization and ≥ 3.00 = High level of Utilization

The results showed that the highest utilized improved cocoa production technology by the farmers was Control of black pod disease with fungicides ($\bar{x}$=3.91). This was closely followed by Fermentation and drying of cocoa pods ($\bar{x}$= 3.84), Control of Capsids with insecticides

(x̄= 3.63), Complete farm and phased farm replanting (x̄= 3.41), Weed control (cultural maintenance) (x̄= 3.55), Fertilizer application (x̄= 3.42), Coupon regeneration (x̄= 3.01) and weed control with herbicides (x̄= 3.11) came 2nd, 3rd, 4th, 5th, 6th, 7th and 8th position respectively on the ranking Table. However, coppicing and grafting of cocoa trees (x̄=2.87) and improved seedlings (x̄= 2.63) came 9th and 10th respectively, recording moderate level of utilization. These technologies that witnessed moderate utilization were equally moderately accessed. This could be as a result that coppicing is always done when a cocoa tree is diseased and old, as was in the case of access to the technology. This agrees with the finding of Akinpelu, Lawal, Ibiremo and Ogunwolu (2021).

Therefore, the highly utilized improved cocoa production technology was Control of black pod disease with fungicides (x̄=3.91) and the moderately utilized improved technology by the rural households was improved seedlings (x̄ = 2.63). The grand mean (x̄ = 3.38) recorded, showed that there is high level of utilization of improved cocoa production technologies in the study area. This might be as a result of high level of access of these improved production technologies by the rural households in the study area. This finding collaborates the findings of Nwokocha (2022) and Nwachukwu (2017) that farmers accept and utilize innovations when they are fully aware of the relevance of the innovation; thereby agreeing with the finding of Odoemelam *et al*, (2016), that stated that farmers can only utilize technologies when they are aware of the technologies.

This result is in tandem with the Focus Group Discussion (FGD) result where the rural households in the study area agreed that they utilize very well the improved cocoa production technologies transferred to them.

Test of Hypothesis

H0: There is no significant relationship between the socio-economic characteristics of the members of rural households and their level of utilization of Improved cocoa production technologies in study area

The four functional forms of the multiple regression model were also tried and the Semi-log model was selected as the lead equation due to the highest number of significant variables and a significant F-value of 10.353 at P<0.05 which shows the overall significance of the regression line and a high R^2 value of 0.474 which implies that 47.4% of the total variation in the dependent variable was accounted for by the explanatory variables.

From the result, at P<0.05, Age (-5.014***) was significant and negatively related to cocoa farmers use of technologies. The implication of the result is that the more advanced the respondents are, the less their drive for innovations that will enable them do well in their enterprises. This agrees with the findings of Ukoha and Nzeakor (2020) that age affects the rate of farmer's utilization of innovation, which in turn affects household productivity and livelihood improvement strategies.

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Table 4: Ordinary least square multiple regression results of the relationship between the socio-economic characteristics of the respondents and their utilization of cocoa technologies in the Study area.

Variables	**Semi-log+**
Constant	8.862
	(4.142) **
Age (X_1)	-1.406
	(-5.014) ***
Sex (X_2)	-0.172
	(-1.204)
Marital Status(X_3)	132468.99
	(2.771) ***
Farm Size(X_4)	0.766
	(5.071) ***
Household Size (X_5)	0.045
	(0.197)
Farming Experience (X_6)	0.049
	(0.959)
Educational level (X_7)	0.428
	(2.799) ***
Contact with Extension (X_8)	0.228
	(2.670) **
R^2	**0.474**
Adj.R^2	**0.329**
F. ratio	**10.353*** **

Source: Computed from Field survey, 2024
Key: ** and *** is significant at 5% and 1% level of probability respectively
+ = Lead Equation and the values in bracket are the t-values

Marital status (2.771***) was also significant and positively related to cocoa farmers' utilization of cocoa production technologies in the study area This further agreed with the findings of Osarenren, Ejuetueyin and Eweka (2016) that most cocoa farmers were mature and could effectively take crucial decisions jointly with their spouses. Wives are still used for supportive operations in farm operations.

Farm Size (5.071***) was also significant and positively related to cocoa farmers' utilization of cocoa production technologies in the study area. This implies that, the larger the farm size, the more likely the farmers will use cocoa production technologies in order to maximize profit. This is in line with the findings of Nwokocha (2022) whose results showed a positive relationship between farm size and utilization of improved technologies.

Educational status (2.799***) was also significant and positively related to cocoa farmers' utilization of cocoa production technologies in the study area. Education shapes once orientation and prepares an individual in better attitude and decision making. The result is in agreement of the

findings of Nwaobiala (2014) that level of education aids in supporting the acceptability and utilization of technologies through exchange of information.

At P<0.05, Extension contacts (2.670**) was significant and positively related to cocoa farmers use of technologies. The implication of the result is that the more contact farmers make with extension the more they use cocoa technologies. This is in tandem with a priori expectation. However, the dwindling effectiveness of the ADP has made farmers resort to other sources for advisory services. This finding agrees with that of Ukoha, Agu-Aguiyi, and Onwukwe (2020) the presence of extension contact or high extension contact will positively affect technology utilization among other extension services.

The study therefore rejected the null hypothesis which states that there is no significant relationship between socioeconomic characteristics of the respondents and the utilization of cocoa production technologies.

Conclusion and Recommendations

The study concluded that, there is high level of access to as well as high level of utilization of the improved cocoa production technologies by rural households in the study area.

The study therefore recommends that the technology on improved seedlings that didn't have high access and utilization like the other improved production technologies should be made more available and accessible by technology developers to the rural households and then the cost of the seedlings subsidized by the Government to enhance its utilization for increased cocoa production in the study area.

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