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Attitudes of Cocoa Farmers towards the Adoption of Agro-Eco-System Analysis (AESA) in Ondo State, Nigeria

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Abstract

This study assessed attitudes of cocoa farmers towards the adoption of AESA techniques among farmers in Ondo State, Nigeria. Specifically, the objectives were to: examine cocoa farmers knowledge level on AESA adoption, assess farmers' attitudes towards AESA techniques adoption, and determine the levels of adoption among cocoa farmers. A multistage sampling procedure was employed to select 300 respondents for the study. The first stage involved the purposive selection of two Local Government Areas (LGAs) based on where AESA training was conducted. These are Owena and Ondo East. Second stage also involves a random selection of twenty percent (20%) of the communities in each of the wards (each LGA has an average of ten wards). The third stage involves proportionate sampling cocoa farmers from the list obtained from the Cocoa Farmers Association. This gives a total of 300 cocoa farmers, representing 20% of the population in each of the selected wards. Descriptive and inferential statistics were employed for the data analysis. The result revealed that very few (11.7%) of the respondents had low knowledge of AESA techniques, majority (79.6%) had moderate knowledge, while 8.7% of cocoa farmers had high knowledge. Findings also revealed that 59.7% of respondents were favourably disposed to AESA adoption. The majority, (72.0%) of the respondents had a medium level of adoption while 14.3% and13.7% of the respondents had high and low levels of adoption respectively. The results of Pearson Product Moment Correlation Analysis showing a significant relationship between farmers' knowledge, ($r = 0.204$, $p = 0.000$), attitude ($r = 0.313$, $p = 0.000$) and level of adoption of AESA techniques. The study concludes that AESA adoption among cocoa farmers is moderate. Policy measures such as continuous AESA training should be prioritised to enhance adoption and promote sustainable cocoa farming in Nigeria.

Keywords: *Agro-Eco-System-Analysis, Knowledge, Attitudes and Adoption.*

I. INTRODUCTION

Cocoa (Theobroma cacao L.) remains one of the most important cash crops in Nigeria, contributing significantly to rural livelihoods, employment, and foreign exchange earnings. Nigeria is among the leading cocoa-producing countries globally, with the Southwestern region accounting for the largest share of national output. However, despite its economic relevance, cocoa production in Nigeria is characterized by low productivity, ageing plantations, pest and disease infestations, and unsustainable land-use practices. These challenges are further exacerbated by climate change, biodiversity loss, and limited access to critical production resources such as credit and improved technologies (Amuda & Alabdulrahman, 2024; Kehinde et al., 2024). In response to these challenges, sustainable agricultural approaches have gained increasing attention in cocoa production systems. One such approach is Agroecosystem Analysis (AESA), a participatory and experiential learning tool commonly implemented through Farmer Field Schools (FFS). AESA enables farmers to systematically observe ecological interactions within their farms, including relationships among crops, pests, natural enemies, soil conditions, and climatic factors, thereby enhancing informed decision-making. The approach promotes ecological balance, reduces dependence on chemical inputs, and improves farm resilience (Awodumila & Adebo, 2025). In cocoa-based systems, where ecological complexity plays a crucial role in productivity, AESA is

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particularly relevant for managing persistent challenges such as black pod disease and insect pests.The importance of sustainable and climate-resilient practices in cocoa production has been widely emphasized in recent literature. For instance, agroforestry and biodiversity-friendly production systems have been identified as critical strategies for improving cocoa yields while maintaining environmental sustainability (Kaba et al., 2024). Similarly, studies have shown that integrating ecological knowledge into farming practices can enhance long-term productivity and sustainability outcomes. AESA aligns with these principles by fostering farmers' capacity to understand and manage agroecosystems holistically.

Despite the proven benefits of such innovations, their adoption among smallholder farmers remains uneven. Adoption of agricultural technologies is a complex process influenced by socioeconomic, institutional, and psychological factors. Among these, farmers' attitudes play a pivotal role in shaping their willingness to adopt new practices. Positive attitudes such as perceived usefulness, compatibility with existing practices, and economic benefits encourage adoption, while negative perceptions and risk aversion hinder it. Empirical studies in Nigeria have demonstrated that awareness and perception significantly influence the adoption of improved cocoa technologies (Ademuwagun et al., 2024) Furthermore, participation in extension-based learning platforms such as Farmer Field Schools has been shown to enhance farmers' knowledge, attitudes, and adoption of improved practices. Evidence indicates that farmers who participate in FFS programs exhibit higher levels of technology adoption, resource-use efficiency, and productivity compared to non-participants (Odoemelam et al., 2020). This suggests that approaches like AESA, which are embedded in participatory learning systems, have strong potential to improve cocoa production outcomes if effectively adopted. However, even when awareness of innovations like AESA is relatively high, actual adoption may still be constrained by factors such as limited extension contact, inadequate training, labour requirements, and institutional barriers. Recent findings indicate that while cocoa farmers in Southwestern Nigeria show high awareness of AESA practices, the intensity of adoption varies significantly across different components of the technology (Awodumila & Adebo, 2025). This gap between awareness and adoption underscores the importance of understanding farmers' attitudes as a critical determinant of behavioral change.

In Southwestern Nigeria, where cocoa farming is dominated by smallholder farmers, the success of AESA depends largely on farmers' perceptions, attitudes, and willingness to integrate ecological knowledge into their farming practices. However, there is still limited empirical evidence specifically addressing cocoa farmers' attitudes toward AESA in this region. Such information is essential for designing effective extension strategies, improving adoption rates, and promoting sustainable cocoa production. Therefore, this study examines the attitudes of cocoa farmers toward the adoption of Agroecosystem Analysis (AESA) in Southwestern Nigeria specifically in Ondo State. By identifying the key factors influencing farmers' attitudes and adoption behaviour, the study provides insights that can guide policymakers, extension agents, and development practitioners in promoting sustainable agricultural innovations in the cocoa sector.

- *Objectives of the Study*

  The specific objectives of the study is to;

- Examine the knowledge level of cocoa farmers towards AESA adoption
- Determine the attitudes of cocoa farmers towards the adoption of AESA techniques
- Asses the level of adoption of AESA techniques among cocoa farmers in southwest, Nigeria

- *Hypothesis of the Study*

- Ho_1: There is no significant relationship between knowledge, attitudes and level of adoption of AESA techniques among

II. METHODOLOGY

The study was carried out in Ondo State, Nigeria. A multi- stage sampling procedure was used to select respondents for the study. The first stage involved the purposive selection of two Local Government Areas (LGAs) based on where AESA training was conducted. These are Owena and Ondo East. Second stage also involves a random selection of twenty percent (20%) of the communities in each of the wards (each LGA has an average of ten wards). The third stage involves proportionate sampling cocoa farmers from the list obtained from the Cocoa Farmers Association. This gives a total of 300 cocoa farmers, representing 20% of the population in each of the selected wards. Structured questionnaire, administered in the form of interview, was used to gather information from respondents. Apart from the socioeconomic characteristics of farmers, other key variables as implied in the research questions were measured. Knowledge of AESA techniques was measured by drawing questions on AESA techniques on a three - point ordinal scale of 'fully understand' (2), 'Understand somewhat' (1), and 'Do not understand' (0). A knowledge score was obtained and the mean was computed and used as a benchmark for low, medium and high knowledge dichotomies. Attitude to AESA adoption was measured as farmers were presented with a list of some attitudinal statements. It was measured using a five-point likert scale of 'strongly agreed', 'agreed', 'undecided', 'disagreed' and 'strongly disagreed' with scores 5, 4, 3, 2, and 1 assigned, respectively. Attitudinal statement score was obtained and the mean was computed and used as a benchmark for low, and high attitude categories. Level of adoption of AESA were measured by asking respondents how many of AESA techniques out of the ten listed have been adopted in their cocoa farm. Scores were allocated as follows, 'never adopted' scored 0, 'occasionally adopted' scored 1 and 'full adopted' scored 2. This gave a minimum score of 0 and a maximum score of 20. The mean and standard deviation were calculated. Mean ± Std was used

as a criterion to categorize respondents into high, medium and low adoption level

III. RESULTS AND DISCUSSION

- *Categorisation of Cocoa Farmers' Knowledge Level of AESA Techniques*

As seen in Table1, very few (11.7%) of the respondents had low knowledge of AESA techniques, majority (79.6%) had moderate knowledge, while 8.7% of cocoa farmers had high knowledge. Since the majority of the farmers had moderate level of knowledge of these technologies, there is the possibility of adopting the technology. Akinbile *et al (*2014) affirmed that knowledge of innovation makes it probable that such an innovation would be adopted. However, Famuyiwa *et al (*2017) stated that farmers' knowledge of a given technology do not lead to adoption due to some factors. Farmers may not adopt technology that is too technical for them to understand and practice despite the awareness for instance, Uwagboe (2017) found out that the level of literacy of farmers influences the awareness, knowledge and adoption of agricultural technologies. Illiterate farmers may not adopt innovation despite the advantages of such innovation due to its complexity. The cost implication of executing new technologies may discourage farmers from adopting. In addition to that, they might resist adopting new AESA practices due to the perceived risks involved.

Table 1 Categorisation of Cocoa Farmers' Knowledge Levels on AESA Techniques.

Categories of Knowledge Level	Scores	Frequency	Percentage	Mean & Std
Low	≤7.4	35	11.7	
Moderate	7.5-14.7	239	79.6	11.1±3.7
High	≥14.8	26	8.7	
Total		300	100.0	

Source: Field Survey, 2026.

- *Attitude of Respondents Towards AESA Adoption.*

The findings displayed in Table 2 indicate that the majority (70.3%) of the cocoa farmers agreed that they were aware of different AESA techniques that can be applied to cocoa farming. Few (3.3% and 1.3%) of them respectively disagreed and strongly disagreed that they were aware of different AESA techniques. The high percentage (70.3%) of farmers who are aware of different AESA techniques suggests the possibility of its adoption by farmers. This finding is consistent with the report of Awodumila and Adebo (2025), who found a high level of awareness of agro-ecosystem analysis techniques among cocoa farmers in Southwestern Nigeria.

The majority (52.7%) of the respondents agreed that they feel confident in their knowledge and ability to implement agroecosystem analysis, while 3.3% and 3.0% of the respondents disagreed and strongly disagreed, respectively. This supports the findings of Adebayo et al. (2021), who reported that farmers' knowledge, education, and extension contact significantly influence the adoption of improved cocoa technologies. In addition, over three-quarters (76.3%) agreed that the adoption of AESA techniques has increased cocoa yield on their farms. These are the set of farmers who probably see cocoa farming as a profitable venture and are more open to adopting innovations to maximize returns. Similar findings were reported by Adebayo et al. (2021), who observed that improved agricultural technologies contributed to higher cocoa productivity among Nigerian farmers.

Also, very few (3.7%) of the respondents strongly agreed that AESA techniques are very risky. This shows that most respondents did not perceive the technology as risky. Similarly, Ogunya (2024) reported that farmers with positive perceptions of agricultural technologies were more motivated to adopt sustainable cocoa production practices. More than half (55.0%) agreed that the adoption of AESA techniques has increased their standard of living. This finding agrees with Ogunya (2024), who noted that technology adoption among cocoa farmers contributes to improved livelihoods and farm income. Very few (8.7%) of the respondents possessed access to the requisite resources, indicating that the majority lacked the necessary resources to adopt AESA techniques. This agrees with Adebayo et al. (2021), who identified access to credit and institutional support as important determinants of technology adoption. A greater percentage (65.0%) of the respondents agreed that support from agricultural extension services helped them understand and implement AESA techniques. This finding corroborates Arimi and Omoare (2021), who found that extension services significantly motivated cocoa farmers to adopt agroforestry practices for sustainable production.

More than half (76.3%) believed that AESA adoption can lead to higher cocoa yields, while 77.0% believed that AESA enhances cocoa quality. This finding is consistent with Daudu et al. (2021),who reported that adoption of recommended quality improvement practices enhances cocoa quality and export competitiveness. The majority (70.0%) agreed that AESA enhances environmental sustainability, while 72.3% agreed that biodiversity protection is important. This supports the findings of Arimi and Omoare (2021), who reported that sustainable practices such as agroforestry improve biodiversity conservation and climate resilience in cocoa farming. Many (74.0%) agreed that they are willing to take the risk of trying new agroecosystem practices on their cocoa farms. However, very few (3.7%) strongly agreed that adopting AESA techniques would be too difficult or time-consuming. These findings agree with Ogunya (2024), who found that favourable attitudes increase farmers' willingness to adopt new agricultural technologies.

The majority (71.0%) agreed that they value traditional farming methods while remaining open to integrating agroecosystem techniques. Similarly, 74.3%

agreed that combining traditional and agroecosystem techniques is the best approach for cocoa farming. These findings support Akinmolafe et al. (2021), who reported that cocoa farmers generally exhibit favourable attitudes toward Good Agricultural Practices while maintaining useful indigenous farming practices. The majority (72.2%) agreed that AESA adoption will assist the government in increasing foreign earnings through improved cocoa quality and productivity. This perception aligns with Daudu et al. (2021), who emphasized that improved bean quality increases the competitiveness of Nigerian cocoa in international markets.

Table 2 Distribution of the Respondents Based on the Attitude Towards AESA Adoption

SN	Attitudinal Statements	SA %	A %	U %	D %	SD %	Mean
1	I am aware of different AESA techniques that can be applied to cocoa farming.	18.7	70.3	6.3	3.3	1.3	4.02
2	I feel confident in my knowledge and ability to implement agroecosystem analysis	31.0	52.7	10.0	3.3	3.0	4.05
3	Adoption of AESA techniques has increased cocoa yield on my farm	14.7	76.3	4.0	2.0	3.0	3.98
4	AESA techniques are very risky being a new technology	3.7	45.3	8.3	23.3	19.7	2.98
5	Adoption of AESA techniques has enhanced my standard of living	12.0	55.0	25.0	2.0	6.0	3.65
6	I have access to the necessary resources to adopt agroecosystem analysis techniques	8.7	22.3	9.7	23.7	35.7	2.45
7	Lack of resources is a significant barrier for me in adopting agroecosystem practices	30.7	46.0	8.3	11.0	4.0	3.88
8	The support from agricultural extension services has helped me understand and implement agroecosystem practices	6.0	65.0	10.7	11.0	7.0	3.52
9	I believe AESA can lead to a higher yield in cocoa production	14.3	76.3	6.3	1.0	2.0	4.00
10	I think adoption of AESA techniques can improve the overall quality of the cocoa produced on my farm.	14.3	77.0	6.7	0.3	1.7	4.02
11	I am concerned about the environmental impact of the conventional method and believe that the agroecosystem techniques could enhance a sustainable environment	12.3	70.0	14.0	2.0	1.7	3.89
12	Protecting the biodiversity of my farm through the Adoption of AESA is important to me	15.0	72.3	9.7		3.0	3.96
13	I am willing to take the risk of trying new agroecosystem practices on my cocoa farm.	10.3	74.0	12.7	2.3	0.7	3.91
14	I believe that agroecosystem techniques may help reduce the risk of crop failure	11.7	68.3	16.7	2.3	1.0	3.87
15	I believe that adopting agroecosystem techniques would be too difficult or time-consuming."	3.7	43.0	13.0	19.3	21.0	2.89
16	I am concerned about the costs associated with transitioning to agroecosystem practices"	20.3	56.0	12.0	10.0	1.7	3.83
17	I value traditional farming methods, but I am open to integrating agroecosystem techniques into my cocoa farming practices	9.3	71.0	14.3	4.0	1.3	3.83
18	I believe a combination of traditional and agroecosystem techniques is the best approach for cocoa farming	9.0	74.3	13.3	2.3	1.0	3.88
19	Adoption of AESA techniques does not promote farm sanitation	2.7	24.3	24.7	20.0	28.3	2.53
20	Adoption of AESA techniques by farmers will assist the government in foreign earning	15.0	72.0	11.0	1.3	0.7	3.99

Source: Field Survey 2026

- *Categorisation of Respondents' Attitude Towards AESA Techniques Adoption.*

Farmers' attitudinal disposition was categorised into positive and negative (Table 3). This was determined as the mean attitudinal scores were computed and used as the benchmark, such that respondents' whose scores were below the addition of mean score and standard deviation were categorised as having a negative attitudinal disposition towards AESA techniques. In contrast, scores equal to or greater than the addition of mean score and standard deviation were categorised as having a positive attitudinal disposition. The result shows that a majority (59.7%) of the respondents had a positive disposition towards AESA adoption while 40.3% had a negative disposition with mean and Standard deviation of 3.6535 ±0.39947. The positive disposition of most of the farmers

was as a result of the benefits they have derived from adopting AESA techniques while efforts need to be geared towards training and re-training of farmers with a negative mindset towards AESA adoption The pre-disposition of cocoa farmers towards AESA adoption is largely determine by their levels of awareness, knowledge and practices of the technologies.

Table 3 Categorisation of Respondent's Attitude Towards AESA Techniques Adoption.

Categorisation	Scores	Frequency	Percentage	Minimum	Maximum	Mean	Std
Positive	4.2-4.6	179.1	59.7	1.0	4.6	3.6535	0.3995
Negative	1.0-4.1	120.9	40.3				

Source: Field survey: 2026.

➢ *Respondents' Adoption Level*

Table 4 reveals that majority (72.0%) of the respondents had a medium level of adoption while 14.3% and13.7% of the respondents had high and low levels of adoption respectively.

This distribution suggests that the majority of cocoa farmers in the study area are aware of and utilize some AESA technologies, but not to their full potential. Only a small portion fully adopts the techniques. Many farmers might be aware of improved farming technologies but lack a full understanding of their benefits or how to implement them effectively. Ajewole (2020) observed that Nigerian farmers often adopt only selected available technologies due to limited technical knowledge. Obuobisa-Darko (2015) highlighted cost as a major barrier to full adoption of cocoa innovations in Ghana. Asenso-Okyere and Mekonnen (2012) stated that inadequate farmer-extension interaction hinders the dissemination of new agricultural technologies. Without financial assistance, low-income farmers cannot invest in technology. Mensah and Brummer (2016) linked access to finance directly to the adoption of high-yielding cocoa varieties in Ghana. Farmers may be hesitant to abandon techniques passed down through generations. Aidoo and Fromm (2015) noted that risk aversion and attachment to familiar methods limit adoption levels.

A small group of well-informed farmers often act as early adopters, taking advantage of modern techniques like AESA to improve cocoa production. In other for farmers to fully adopt new technologies like AESA, there is need to strengthen Agricultural Extension Services by government and NGOs to increase their frequency and quality of farmer training and field demonstrations. Also, there must be access to finance by cocoa farmers, this can be done by introducing flexible credit schemes and input subsidies targeting smallholder cocoa farmers. Farmer's cooperatives must be encouraged this can facilitate collective training, purchasing, and sharing of tools and knowledge among farmers FAO (2017) reported that farmer cooperatives in Côte d'Ivoire boosted adoption of digital platforms and improved practices.

Table 4 Distribution of the Respondents Based on the Level of Adoption Categories

Categories	Scores	Frequency	Percentage
High	>5.43	43	14.3
Medium	2.34- 5.43	216	72.0
Low	<2.34	41	13.7
Total		300	100

Source: Field Survey, 2024

Mean: 3.8896, Std: 1.54515

➢ *Test of Hypotheses*

$H_{O1:}$ The results of Pearson Product Moment Correlation Analysis showing relationship between farmers' knowledge, attitude and level of adoption of AESA techniques

The significant positive correlation (r = 0.204, p = 0.000) suggests that higher knowledge levels are associated with greater adoption of AESA. While the correlation is relatively weak, it confirms the well-established principle that awareness and knowledge is a prerequisite for adoption (Rogers, 2017). It implies that farmers who are more aware and have knowledge of an innovation are more likely to adopt it. Therefore, effective extension strategies (e.g., farmer field schools, demonstration farms, and digital outreach) are essential. The strength of this relationship suggests that simply being aware and have knowledge is not enough, other factors like training, access to inputs, and perceived benefits influence actual adoption. Extension programs should prioritize practical demonstrations alongside information dissemination (Feder *et al*., 1985), while the government and agricultural development agencies should strengthen farmer awareness campaigns through radio, social media, and farmer cooperatives to improve adoption rates.

The moderate positive correlation (r = 0.313, p = 0.000) suggests that a more favorable attitude towards the innovation significantly enhances adoption. This aligns with findings from previous studies, which emphasize that perception and willingness to accept change are crucial factors in adoption (Doss, 2006). It implies that farmers' attitudes towards new practices depend on perceived benefits, risks, and past experiences. Agricultural extension programmes should incorporate success stories and testimonials to improve perception and encourage adoption. Since attitude plays a more significant role than knowledge alone, training programmes should go beyond

technical knowledge and focus on behaviour change techniques. This can be done through participatory approaches that engage farmers in problem-solving. Financial incentives (such as input subsidies or credit access) can improve attitudes toward adoption, especially if initial costs or risks are perceived as barriers.

Table 5 PPMC Result of the Relationship Between Knowledge, Attitude and Level Adoption of AESA Techniques.

Variable	r-value	p-value	Decision
Knowledge	0.204	0.000	S
Attitude	0.313	0.000	S

Source: Field Survey, 2026.
Significant at 0.05%

IV. CONCLUSION AND RECOMMENDATIONS

➢ *Conclusion*

This study investigated the attitude of cocoa farmers towards the adoption of Agro-Ecosystem Analysis (AESA) techniques among cocoa farmers in Ondo State, Nigeria. The findings revealed that most of the farmers had moderate knowledge of AESA techniques, with greater familiarity in areas related to pesticide safety and cocoa pest identification. However, greater percentage of farmers generally had favourable attitudes towards AESA , which significantly influenced their adoption. The actual adoption remained at a moderate level. There is a significant relationship between knowledge, attitude and adoption of AESA techniques.

➢ *Recommendations*

The study advances these recommendations for the full adoption of AESA and sustainable cocoa production in Southwest Nigeria.

- There is a need to strengthen AESA Training and Awareness Campaigns. Targeted training programs should focus on the less-understood aspects of AESA.
- Promoting Group-Based Learning Platforms will go a long way to enhance the adoption of AESA techniques.
- Incentivising AESA Adoption through Input Support is also necessary. Input subsidies (such as for biopesticides or improved cocoa seedlings) and labour-sharing schemes should be considered, particularly for smallholders with large cocoa plots.
- AESA Adoption requires Policy Support and Integration. The National agricultural policies should formally recognise AESA as a sustainable practice and integrate it into cocoa development programs, with appropriate funding and technical support.
- The establishment of AESA demonstration plots in local communities will allow farmers to witness practical benefits, thereby influencing their perception and willingness to adopt.

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