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ANALYSIS OF THE CHALLENGES OF CASHEW REHABILITATION TECHNIQUES (CRTS) IN OSUN STATE, NIGERIA

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ABSTRACT

Aim: This study sought to analyze the challenges faced by cashew farmers in the adoption of cashew rehabilitation techniques (CRTs) in Osun State, Nigeria. **Methods:** Data was collected from primary sources using structured questionnaires. A total of eighty (80) respondents were considered, forty (40) from each of the selected local government areas. The study adopted descriptive analysis to examine the socio-economic characteristics of the farmers, multinomial logistic (MNL) regression was used to evaluate the factors affecting the level of adoption of the CRTs while a Likert scale was adopted to measure the level of severity of identified constraints to CRTs adoption in the state. **Results:** The adoption level of coppicing is significantly affected by farm size, age of farmers and access to extension services. The adoption level of side-grafting is affected by farm size and level of education, and the level of adoption of total replanting is significantly influenced by age of farmers, age of farms and level of education. High labor costs, the high cost of agrochemicals and a labor shortage are highly severe constraints to the adoption of CRTs, while a lack of adequate knowledge and the existence of fire incidences are considered to be mildly severe constraints. **Conclusions:** Adoption of techniques is affected by factors such as age, education, farm size, and access to extension. Constraints to adoption include a lack of knowledge, high labor and chemical costs, labor shortage, and fire risk. Farmer education is highly encouraged to improve the technology adoption among cashew farmers in the study area.

Key words: cashew, rehabilitation, techniques, constraints, CRT adoption

JEL codes: D91, O39, Q16

INTRODUCTION

The cashew (*Anacardium Occidentale* L.) is a tropical economic crop that originates from the Amazon basin in Brazil [Subbarao et al. 2011]. The crop was introduced to Africa and Nigeria in particular by Portuguese explorers around the 15th and 16th centuries [Asogwa et al. 2009]. Individuals were initially obscured to the economic and commercial potentials of the crop, as the tree was only planted for erosion control at the time. However, the commercial value of the crop was later discovered as demand for the crop keeps rising in the global market [Tola and Mazengia 2019]. The cashew has since become a global economic crop and remains a major source of revenue for many economies around the world.

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The cashew is one of the most valued crops in the Nigeria agricultural sector. According to the Food and Agriculture Organization (FAO) of the United Nations [2020], the value of the crop was just below that of cocoa and sesame seed in the year 2020. The cashew, along with cocoa, oil palm and the peanut, was among the top export commodities in Nigeria before the discovery of oil in the 70s. The crop, along with other agricultural commodities, was affected by the discovery of oil and the shift of the Nigerian economy away from agriculture [Clinton-Etim and Manishimwe 2021]. Despite the discovery of oil in the 70s, the cashew still experienced a gradual increase in production over the years; although the growth in yield was not encouraging. Cashew nut was 800,000 tons in 2009. However, according to the FAO [2020], in the year 2011, the production of cashews in Nigeria started to plummet and by 2014, the production value had dropped to 126,490 tons. There have been some concerns about the low yield of cashews in Nigeria. However, when the actual production quantity fell, there was genuine panic among cashew producers and other stakeholders. Many causes have been attributed to the fall in cashew production and yield. Oluyole et al. [2015] cited a lack of adequate labor as one of the reasons. Asogwa et al. [2008] opined that the increased infestation of pests and diseases is a cause of the low cashew yield.

Furthermore, there has been an institutional effort geared at addressing the problem of the low yield in Nigeria, which has resulted in the development of various rehabilitation techniques in a bid to rehabilitate and regenerate the cashew farms to improve the cashew production yield and quality. According to Oluyole et al. [2015], some of the benefits of farm rehabilitation include an increase in yield, weed control as well as control of pests and diseases. However, despite the introduction of technologies in cashew rehabilitation techniques (CRTs) that are available, cashew productivity is still to recover to a satisfactory level, which leads to the question of what factors are militating against cashew rehabilitation practices in Nigeria?

To answer the above question, there is a need to take a cogent look into the challenges of cashew rehabilitation techniques in Nigeria since with such rehabilitation practices, the cashew output is expected to increase, hence the need for this study.

With respect to the above, the study seeks to achieve the following objectives:

- to examine the socio-economic characteristics of cashew farmers in Osun State
- to identify the challenges faced by farmers in cashew rehabilitation
- to analyze the impact of these challenges on the adoption of the CRTs

THEORETICAL REVIEW

Adoption of new technology in agriculture is a complex process that involves various factors. Here are some theoretical backgrounds for the adoption of new technology in agriculture.

Diffusion of Innovations Theory: Developed by Rogers [2003], this theory explains how innovations (including agricultural technologies) spread through a population over time. It classifies individuals into categories, such as innovators, early adopters, early majority, late majority, and laggards, based on their willingness to adopt new technologies. Factors influencing adoption include the innovation's relative advantage, compatibility, complexity, trialability, and observability.

Technology Acceptance Model (TAM): TAM focuses on the user's perceived ease of use and perceived usefulness of a technology. It posits that users are more likely to adopt a technology when they believe it is easy to use and will enhance their work or life [Marangunić and Granić 2015]. TAM has been applied to the context of agricultural technology adoption, emphasizing farmers' perceptions of how technology can improve their farming practices.

Theory of Planned Behavior (TPB): People's desire to embrace a technology is determined by their attitude toward the technology, subjective norms (influence of peers and society), and perceived behavioral control (self-efficacy), according to the TPB. Farmers' ideas and attitudes toward agricultural technology can have a substantial impact on their willingness to adopt it [Senger et al. 2015].

Innovation-Decision Process: This framework divides the technology adoption process into five stages: knowledge, persuasion, decision, implementation, and confirmation. It acknowledges that not all potential

adopters will go through all of these stages, and that the process is influenced by factors such as the perceived features of the innovation, communication routes, and the social structure [Meena and Singh 2012].

Economic Theory: Economic reasons frequently impact agricultural technology adoption. Farmers analyze the costs and benefits of adopting a technology, taking into account factors such as predicted production gains, lower labor or material costs, and potential dangers. Understanding these decisions relies on a cost-benefit analysis and economic modeling [Gallardo and Sauer 2018].

MATERIALS AND METHODS

Study Area

The study was carried out in Osun State, Nigeria. The capital of Osun State is Osogbo, the state covers an area of about 14, 875 sq. kilometers and it is bounded by Ogun State to the south, Oyo State in the West, Ondo and Ekiti States in the East and Kwara State in the north. The state lies between longitude 6°51'N and 8°N and latitude 4°05'E and 5°02'E [Fakayode et al. 2012]. Osun State has a population of over three million people and is divided into six administrative zones, namely Ife, Ila, Ikirun, Iwo, Ilesa and Osogbo [Nigerian Population Census 2006].

Sampling Technique

A multistage sampling procedure was adopted in the course of this study. The first stage involved the purposive selection of the Iwo administrative zone out of the six zones due to the prominence of cashew production in this zone. The next stage involved the random selection of two Local Government Areas (LGAs), which were the Ejigbo and Iwo LGAs. The third stage involved the random selection of 40 cashew farmers from each of the LGAs previously selected. This was done from a list of cashew farmers provided by the Agricultural Development Projects (ADPs) (180 from Ejigbo and 200 from Iwo).

Likert Scale

Likert scales can be used to measure a variety of variations, including agreement, likelihood, frequency, importance, and quality [Matell et al. 1972]. Responses to several Likert questions can be summed and treated as interval data measuring a latent variable, to which parametric statistical tests, such as the analysis of variance, can be applied. While some researchers argue that three-point scales contain less information and can introduce rounding errors, others suggest that they can be sufficient in some cases and do not necessarily diminish the reliability or validity of the resulting scores [Jacoby et al. 1971, Taherdoost 2019]. A three-point Likert scale is a type of rating scale used to measure attitudes or opinions. Respondents are asked to indicate their level of agreement or disagreement with a statement using three possible responses, such as "agree," "undecided," or "disagree." A three-point Likert scale was used to analyze the severity of the constraints affecting the adoption of cashew rehabilitation techniques in Osun State, where the possible responses were: Not Severe = 1, Severe = 2 and Very Severe = 3.

Multinomial Logistic Regression

The multinomial logistic model is an extension of the Logit model. The multinomial logistic regression (MLR) model is used to estimate models where the dependent variable can assume more than two categorical values. The model is specified thus:

$$Zij = \beta_0 + \beta_1 AGE + \beta_2 FAGE + \beta_3 LOE + \beta_4 FS + \\ + \beta_5 EXTC + \beta_6 KCRT + e \quad (1)$$

Zij = Adoption levels for each of the CRTs

The CRTs considered included: Coppicing, Side Grafting, and Total Replanting, for which the adoption levels for each were: Not Adopted, Low Adoption and High Adoption.

AGE – age of farmers measured in years
FAGE – farm age in years
LOE – level of education in years of schooling
FS – farm size in hectares
EXTC – contact with extension agent
KCRT – knowledge of CRTs.

RESULTS AND DISCUSSION

Descriptive statistics of the socio-economic characteristics of cashew farmers in the study area are shown in Table 1. The table shows that the mean age

of the cashew farmers is about 53 years. This implies that the majority of the farmers are aging but still in their productive years. This agrees with the findings of Akinpelu et al. [2021], who reported an average age of 53 years for cashew farmers in Oyo State. Furthermore, the table also reveals that the mean age of cashew farms is about 18 years, showing that the majority of the cashew farms in Osun State are relatively young, at less than 20 years old, which may dissuade the farmers from adopting any of the rehabilitation techniques because there may be no need for rehabilitation since the farms are likely to be in their productive stage. This result contrasts with the findings of Ogunwolu et al. [2020], who asserted that the majority of cashew farms in Nigeria are aging. The maximum level of education attained by the cashew farmers in Osun State is tertiary education. The table shows that the majority of the farmers have at least secondary education. This implies that the farmers may be more informed about new technologies. According to Amaegberi and Oyintonbra [2023], education is crucial for promoting the adoption of new technology and techniques, increasing production and profitability, and boosting the competitiveness of the cashew farming industry as a whole. This contrasts with the findings of Akinpelu et al. [2021], who stated that most of the cashew farmers in Oyo State are unlearned. The average household size (number of persons in the household) of the cashew farmers in Osun State is about 8 persons per household, as shown in the table; the implication of this is that the farmers are likely to have more hands to assist them on the farm. Furthermore, the table shows that the average farm size of cashew farmers is about 3 hectares of cashew farmland per farmer; this shows that majority of the cashew farmers are smallholders. This is in line with the findings of Kakwagh et al. [2023]. The average cashew crop harvested by the farmers is about 2.3 tons per year in Osun State.

The factors affecting the adoption level of CRTs among cashew farmers in Osun State are presented in Table 2. The results show that a unit increase in the age of farmers will result in about a 61% decrease in the adoption level of coppicing at a 10% probability level. This implies that the farmers are unwilling to adopt coppicing as a method of rehabilitation as they get older. This contradicts the findings of Adeogun et al. [2010], who stated that the age of farmers is positively correlated with the rehabilitation information sources, leading to greater adoption as a farmer gets older. However, farmers are willing to adopt total replanting as they get older. A unit increase in the age of farmers will result in about a 10% increase in the adoption level of farmers at a 5% probability level. This is contrary to the expected, as older farmers are usually unwilling to replant trees, especially when the current trees are old. In contrast, it is revealed that a unit increase in the age of cashew farms will result in about 64% decrease in the adoption level for total replanting. This shows that farmers with old farms are generally unwilling to adopt total replanting, as they may feel it is too risky and they would rather stick with the old trees. Furthermore, an increase in the level of education of farmers will result in a greater level of adoption of side-grafting at a 5% level of probability. Educated farmers are more exposed to and have learned about the benefits of side-grafting,

Table 1. Summary statistics of socio-economic characteristics of cashew farmers in Osun State, Nigeria

Variables	Mean	Standard Deviation	Minimum	Maximum
Age of Farmers	53.23	16.81	20.0	85
Age of Cashew Farms	18.30	10.27	2.0	50
Level of Education	2.71	0.97	1.0	4
Household Size	8.16	4.29	4.0	25
Farm Size (Hectares)	3.05	2.55	0.4	12
Quantity Harvested (Tons)	2.31	0.92	0.5	4
Number of observations: 80				

Source: Author's field survey, 2021.

Table 2. Factors Affecting the Adoption of CRTs in Osun State

Variables	Coppicing	Side Grafting	Total Replanting
Age of Farmers	–0.61(–1.68)*	–0.26(–0.56)	0.10(2.48)**
Age of Cashew Farms	0.50(0.90)	–1.48(–1.56)	–0.64(–2.49)**
Level of Education	–0.86(–1.38)	2.03(1.97)**	–0.81(–1.82)*
Farm Size	0.43(1.77)*	0.64(1.83)*	–0.18(–0.10)
Contact with Extensionist	1.93(1.67)*	–2.02(–1.26)	–0.29(–0.33)
Number of observations: 80			

Note: *, ** and *** imply significance at 1%, 5% and 10%, respectively, while values in parentheses indicates the *t*-values.

Source: Author's Field Survey, 2021.

hence they are expected to adopt it more than their less educated counterparts. This, however, contradicts the findings of Oluyole et al. [2015], who discovered that most farmers are unwilling to adopt side-grafting in Nigeria despite their education level. In contrast, an increase in the level of education of farmers results in a decrease in the adoption level for total replanting at a 5% level of significance. This may be due to the fact that educated farmers are equipped with information on the risk and uncertainty involved with the adoption of total replanting. Furthermore, an increase in the farm size by one hectare will result in about a 43% increase in the adoption level for coppicing at a 10% level of probability. This corroborates the findings of Taiwo et al. [2015], who stated that coppicing is the second most widely adopted rehabilitation technique, especially among large-scale farmers. The same can be said for the adoption of side grafting; an increase in the farm size by one hectare will result in an increase in the adoption level of side-grafting by 64% at a 10% probability level. This is in line with the a-priori; farmers with bigger farms should be more willing to adopt rehabilitation techniques due to the number of trees on their farm. The table also shows that farmers who have regular contact with extension agents are more willing to adopt coppicing as a method of rehabilitation.

Severity of the constraints affecting the adoption of cashew rehabilitation techniques

The range for the three-point Likert scale technique adopted to investigate the severity of constraints affecting the adoption of CRTs in Osun State is depicted in Table 3. Based on the assigned values for each of the responses, the mean score for each respondent was derived by summing the numerical values of their responses and dividing by the total number of questions. The mean value that falls within a range implies the state of the constraint considered.

Table 3. Scoring range of Likert scale of the survey

Scale	Range	Response
1	1–1.67	Not Severe
2	1.68–2.33	Severe
3	2.34–3.00	Very Severe

Source: Author's calculation.

Presented in Table 4 is the mean value for each of the considered constraints to the adoption of CRTs in Osun State. From the table, it can be deduced that a lack of awareness of cashew farm rehabilitation (LACF) is not considered a severe constraint to the adoption of CRTs. This implies that increasing the farmers' awareness about CRTs is not enough; farmers need to be encouraged to adopt these techniques. Lack of knowledge of the techniques (LAKNT) is considered by the majority of the farmers to be a severe constraint to the adoption of CRTs. This implies that farmers' inadequate knowledge about CRTs may be one of the major reasons why many are reluctant to adopt the techniques. This is in line with the findings of Adebiyi and Okunlola [2013], who stated that a lack of information about rehabilitation techniques is still a major reason behind the

non-adoption of rehabilitation techniques. High labor cost (HLBC) is considered by most of the farmers as a very severe constraint to the adoption of CRTs in Osun State. This is expected because most of the CRTs require additional labor hours, which the farmers may find expensive. Adebiyi and Okunlola [2013] cited the high cost of labor as one of the main reasons for non-adoption of rehabilitation technique by farmers. The majority of the farmers find the high cost of agrochemicals and other inputs (HCACH) a very severe constraint to the adoption of CRTs. The implication of this is that if farmers are to be encouraged to adopt CRTs, the input cost and agrochemical costs must be subsidized. Most of the farmers find Labor shortage (LABSH) a very severe constraint to the adoption of CRTs. According to Agbongiarhuoyi et al. [2015], cashew farmers complain of a shortage of labor as the majority of the available labor pool is only in search of white-collar jobs; adopting a CRT will require more labor and this will place a burden on the farmers. Olufemi et al. [2021] opined that youths do not find cashew farming economically attractive enough, hence there is a dearth of youth involvement, resulting in a reduction of available labor for cashew production. Fire incidence (FIRENC) is considered to be a severe constraint to the adoption of CRTs in Osun State; many farms are often faced with the risk of being engulfed by a fire outbreak, so it is logical that farmers are reluctant to adopt any of the CRTs due to the fear of fire. According to Lawal and Uwagboe [2017], cashew farmers in Nigeria constantly face the risk of a fire outbreak, especially in the dry season.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this study, it can be concluded that the majority of the cashew farmers surveyed are educated smallholders who are still in their productive years, and their farms are relatively young, hence there may not be a need to rehabilitate them. The level of adoption of coppicing is affected by factors such as the age of the farmers, farm size and contact with extension agents. The level of adoption of side-grafting is affected by the level of education of the farmers and the farm size, while the level of adoption of total replanting is affected by the age of the farmers, age of their cashew farms and their level of education. The major constraints to the adoption of CRTs identified by this study include a lack of knowledge of the techniques, high labor cost, high cost of agrochemicals, shortage of labor, and fire incidence. This is in line with some of the adoption theories explored. According to the innovation-decision process, knowledge is the first stage in the adoption of technology. If knowledge is a constraint, then there needs to be more efforts geared towards educating the farmers. The economic theory of adoption states that farmers will adopt only technologies that they find economically viable, hence the high cost of labor and agrochemicals are legitimate reasons why farmers may refuse to adopt a rehabilitation technique.

Based on the findings of this study, it is recommended that farmers should be more exposed to extension agents and training on cashew rehabilitation, as this will enhance the rate of adoption of the CRTs, as portrayed in the case of coppicing. This training and contact with extension agents should be focused on the older farm-

Table 4. Mean values for CRT adoption constraints

Constraints	LACF	LAKNT	HLBC	HCACH	LABSH	FIRENC
Mean	1.64	1.79	2.64	2.77	2.34	1.75

Note: LACF: Lack of awareness of cashew farm rehabilitation; LAKNT: Lack of knowledge of the techniques; HLBC: High labor cost; HCACH: High cost of agrochemicals and other inputs; LABSH: Labor shortage; FIRENC: Fire incidence.

Source: Author's calculation

ers, since they are less receptive to the adoption of coppicing. This will improve the farmers' knowledge of CRTs. There is also a need for a proper land reform act that will enable the farmers to access larger farmlands at affordable prices, since the majority of the farmers are smallholders. Perhaps larger farm sizes will improve the level of adoption of CRTs. The government should endeavor to subsidize the cost of the agrochemicals used by farmers, as this will encourage them to adopt CRTs and ultimately improve their output.

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ANALIZA WYZWAŃ ZWIĄZANYCH Z TECHNIKAMI ODNAWIANIA UPRAWY NERKOWCÓW (CRT) W STANIE OSUN W NIGERII

STRESZCZENIE

Cel: Celem badania było przeanalizowanie wyzwań stojących przed hodowcami nerkowców w związku z przyjęciem technik rehabilitacji nerkowców (CRT) w stanie Osun w Nigerii. **Metody:** Dane zebrano ze źródeł pierwotnych za pomocą ustrukturyzowanych kwestionariuszy. Łącznie wzięto pod uwagę osiemdziesięciu (80) respondentów, po czterdziestu (40) z każdego z wybranych obszarów samorządu terytorialnego. W badaniu zastosowano analizę opisową w celu zbadania charakterystyki społeczno-ekonomicznej rolników, do oceny czynników wpływających na poziom przyjęcia CRT wykorzystano wielomianową regresję logistyczną (MNL), natomiast do pomiaru poziomu dotkliwości zidentyfikowanych ograniczeń przyjęto skalę Likerta. **Wyniki:** Na poziom wykorzystania zagajników istotny wpływ ma wielkość gospodarstwa, wiek rolników i dostęp do usług doradczych. Na poziom zastosowania szczepienia bocznego wpływ ma wielkość gospodarstwa i poziom wykształcenia, na poziom zastosowania całkowitego ponownego nasadzenia istotny wpływ ma wiek rolników, wiek gospodarstw i poziom wykształcenia. Wysokie koszty pracy, wysokie koszty środków agrochemicznych i niedobory siły roboczej stanowią bardzo poważne przeszkody w przyjęciu CRT, podczas gdy brak odpowiedniej wiedzy i występowanie pożarów uważa się za umiarkowanie poważne przeszkody. **Wnioski:** Na przyjęcie technik wpływają takie czynniki, jak wiek, wykształcenie, wielkość gospodarstwa i dostęp do rozbudowy. Ograniczenia w przyjęciu obejmują brak wiedzy, wysokie koszty pracy i środków chemicznych, niedobór siły roboczej i ryzyko pożaru. Zalecane jest podnoszenie poziomu edukacji rolników, aby wdrażanie technologii wśród rolników uprawiających orzechy nerkowca na badanym obszarze przebiegało sprawniej.

Słowa kluczowe: orzechy nerkowca, odnawianie uprawy, techniki, ograniczenia, zastosowanie CRT