RURAL FARMERS ACCESS TO EXTENSION SERVICES: IMPLICATIONS FOR INCREASED ADOPTION OF IMPROVED FARM TECHNOLOGIES IN DELTA STATE, NIGERIA

Ikoyo-Eweto, G.O. [1], Adedokun, I.F. [2], Archibong, J.P. 3 and Okwuokenye, G.F. [4]
1,2 & 3 Nigeria Institute for Oceanography and Marine Research, Victoria Island, Lagos, Nigeria
4 Department of Agricultural Economics and Ext., Faculty of Agricultural Sciences, National Open Uni. of Nigeria, Km 4, Kaduna Zaria Express Way, Kaduna State.

Corresponding Author's email: ofolunsho@noun.edu.ng; https://orcid.org.0000-0002-3866-0317

ABSTRACT

This study analyzed rural farmers access to extension services and its implications for increased adoption of improved farm technologies in Delta State, Nigeria. It examined the personal characteristics of the respondents of the study, the rate of farmers access to extension services, evaluates the impacts of farmers access to extension services on farm technology adoption and identified the strategies that could be adopted to improve extension service access to farmers. The respondents were randomly selected through multi-stage sampling technique and the data gathered were analyzed using descriptive and inferential techniques. Results revealed that most of the respondents were males (65.96%), married (67.38%), have secondary education (38.29%) have membership with cooperative societies (86.52%) and have access to credit provision (82.27%). The average age, household size, farming experience and farm size was 40.04 years, 7 persons, 10.78 years and 3.23 ha. respectively. The rate of access to extension services was high (45.39%) and that have positively impacted on the farmers in several ways. Several strategies were agreed that can improving the rate of access of farmers to extension services to include: improving on farmers educational level (mean = 4.31) and members of farmers social group (mean = 4.31). Personal characteristics like gender, age, level of education, household size, cooperative membership and farm income were found to significantly affect the rate of farmers access to extension services. The result also showed that farmers access to extension services have also impacted significantly to household welfare. Based on results, the study recommended that there is still need to privatize, if not all but some sensitive aspects of the extension service system that could help to better the farmers output, income and welfare.

Keywords: *Rural farmers, access to extension services, increased adoption, farmers access, extension services and impacts of farmers access*

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INTRODUCTION

Adoption of improved agricultural technologies by small-scale farmers is considered the main route for breaking the poverty trap. When applied correctly, adoption should, all things being equal, increase productivity and provide additional income to farmers. In this way, technology adoption can improve economic growth, create marketing opportunities, and help millions of farmers to move out of poverty (Okwuokenye and Urhibo, 2019). In line with the above, Anang et al. (2020) stated that there is positive relationship between access to agricultural extension and adoption of improve farm technologies which consequently impact on farmers farm income.

The decision of farmers to adopt improved technologies and the speed of adoption is influenced by a multiplicity of economic, social, cultural and sectoral factors. The impact of technology adoption on the welfare of farmers and the factors influencing adoption was well documented in the study of Ayenew *et al.* (2020). Ayenew *et al.* (2020) also expressed that there is significant increases in households' gross farm income and consumption expenditures for innovative farmers and this, they ascribed directly to the adoption of farm technology.

The relationship between adoption rate of farm technologies and the impediments that are discouraging the adoption of the technologies have remained a major challenge (Wossen *et al*., 2015). Access to extension service strengthens the adoption of improved agricultural technologies by reducing supply-side challenges that arise due to information market inadequacies (Wossen *et al.*, 2015). A well-functioning extension system is an essential mechanism for disseminating information and promoting the adoption of new farming technology among rural farmers who otherwise may lack the knowledge of and avenues to new technologies on their own, if not assisted by the extension workers.

An access to agricultural extension information and technology helps farmers to overcoming operational challenges such as financial, supplies, and crop productivity. Agricultural technology can help farmers to increase his/her overall production, reduce their impact on natural ecosystems, and ensure safer growing conditions. Agricultural technology can as well make safer foods available to consumers on the market (Jiva, 2023). Furthermore, access to improved technology and information are essential to increasing adoption. Similarly, Verkaart *et al*. (2017) found that technology adoption significantly increases household income thus, reducing poverty. Efforts to enhance the impact of newly developed farm technologies on smallholders' agricultural production and income have not yielded results (Ghimire and Huang, 2016). This is however not unconnected to the fact that not all farmers have access to such activities and information. With this end in view, the issue of concern now becomes if farmers production level is due to chance and not necessarily because of access to extension services. Thus, this study attempts to determine if farmers' production level is due to chance or possibly because of the status of their level of access to agricultural technologies. This study therefore seeks to examine the rural farmers access to extension services and its implications for increased adoption of improved farm technologies in Delta State, Nigeria. Specifically, the study seeks to: examine the

personal characteristics of the farmers the study, examine the rate of farmers' access to extension services in the area of study, evaluates the impacts of farmers access to extension services on farm technology adoption and identify the strategies that could be adopted to improve extension service access to farmers. It was hypothesized that rural farmers personal characteristics have no significant relationship with the rate of farmers access to extension service.

MATERIALS AND METHODS

Area of study

This study was carried out in Delta State. The State is composed of 25 Local Government Areas (LGAs) and its capital seat is located at Asaba. National Population Commission (NPC, 2022) estimation of the State's population stands at 5,636,100 persons. Delta State is known for its various ethnic and major tribes that include: Isoko, Ika, Urhobo, Itshekiri, Ijaw, Ukwuani and Aniocha. The inhabitants are majorly engaged in: fishing, cropping an animal rearing. Others are known for oil prospecting, civil services, trading and commerce (Okwuokenye, 2022). NAEC (2008) estimated that Delta State has 72 communities in Delta North Agricultural zone, 80 communities in Delta Central Agricultural zone and 48 communities in Delta South Agricultural z one. The area is known to have two distinct seasons which are the dry and the rainy seasons. The state is described to have a monsoon climate with a yearly temperature of 28.64^0C (83.55^0F), its average rainfall is 241.52mm and the State Agricultural services is completely operated by public extension services which are well spread across the three agricultural zones of the State (Delta Climate Summary, 2022).

Validation of research instrument

The research adopted the jury method in validating the research instrument. This method involved the assessment of the instrument by experts in the field of agricultural extension. They actually went through the instruments and ensured that they were of standard, met and addressed the objectives and hypotheses of the study.

Sampling technique and sampling size

The sample was drawn from population of farmers who are being served by the extension agents in the local government areas randomly selected for the study in the State. The sample was selected through the use of multi-stage sampling method. Stage 1 involved the random selection of two (2) agricultural zones in the State. They were Delta North and Delta South. Stage 2 involved the random selection of two local government (LGAs) from each of the zones. That made it four (4) LGAs used for the study (Ndokwa West and Ika South LGAs were randomly selected from Delta North, while from Delta South, Isoko South and Patani LGAs were randomly selected). In stage 3, there was a random selection of two (2) communities / villages per LGA and this brought the LGAs used for the study to eight (8). The randomly selected communities / villages are written in parenthesis of their respectively LGAs as follows. From

Delta North: Ndokwa West (Ogume and Abbi) and Ika South (Ekuku-Agbor, Abavo) were randomly selected. While from Delta South: Isoko South (Oleh and Uzere) and Patani (Patani and Agoloma). Stage 4 has to do with the random selection of twenty (20) farmers per community / village. In total that brought the number of farmers to one hundred and sixty (160). Out of the administered question instruments, one hundred and forty-one (141) (i.e 88.13%) of them which were found suitable were used for the study.

Data Analysis

Descriptive and inferential statistics were used to analyze the data of the study. Descriptive statistics (frequency distribution, percentage and mean) was used for determining the personal characteristics of the respondents, impacts of farmers access to extension services and extent of farmers access to extension services. A five-point Likert scale was used to identify the strategies that could be adopted to improve extension service access to farmers. The scale ranges from, Strongly Agree: coded 5; Agree: (coded 4); Undecided: (coded 3); Disagree: (coded 2) and Strongly Disagree: (coded 1), factors with weighted mean score of 3.0 and above was agreed as strategies that could be adopted to improve extension service access to farmers, while factors with values that are less than 3.0 were considered otherwise. The weighted mean score (3.0) was obtained as follows: (5 + 4 + 3 + 2 + 1) / 5 = 3.0. The impacts of farmers access to extension services on adoption of technology was analyzed on a 4 – point scale. The scale ranked from major impact (rank 4), moderate impact (rank 3), minor impact (rank 2) and insignificant impact (rank 4). In the instance where up to 50% of the respondents indicated an impact was created, then such is ranked as a major impact of the extension services to the farmers. Where the number of respondents is less than 50%, then it is considered that a major impact has not been created.

Inferential statistics involved the use of Logit regression and Product Moment Correlation coefficient (r). Hypothesis 1 (rural farmers personal characteristics have no significant relationship with the rate of farmers access to extension service) was analyzed with the use of Logit regression. Logit analysis was used to position and predict farmers with low access prior to extension services. The variables in the model were measured as and thus expressed below as: gender (dummy: male = 1; female = 0) (X_1), marital status (single = 1; married = 2; divorced = 3; widow(er) = 4) (X_2), age of farmers (years) (X_3), level of formal education of farmers (no formal educ., primary. educ., secondary educ. and post-secondary educ.) (X_4), household size (number of people living and feeding together) (X_5), farm size (measured in hectares) (X_6), farming experience (years) (X_7), cooperative membership (dummy: membership = 1; non-membership = 0) (X_8) and farm income (measured in naira, N) (X_9), against access to extension services (dummy: high = 1; low = 0) (Y). The access to extension services was grouped into two mutually exclusive and exhaustive categories by means of a probability distribution. The model can be represented explicitly by taking it as a probability, p, and making its logarithm depend linearly on the independent variables:

$$\text{Log } P = a+b_1X_1 + b_2X_2b_1 + b_3X_3 + b_4X_4b_1 + b_5X_5 + b_6X_6 + b_7X_7 + e.$$

This is a situation where P approaches O.

Similarly, at the high end of the scale where Y approaches I, Log depends linearly on the independent variables. When both ends of the scale are combined with the model, we get;

Log P. log (1+P) = $a+b_1X_1 + b_2X_2b_1+ b_3X_3 + b_4X_4b_1 + b_5X_5 + b_6X_6 + b_7X_7 + e$. ---------- (1)

That is $\log\left\{\frac{P}{1-P}\right\} - a+b_1X_1 + b_2X_2b_1+b_3X_3 +b_4X_4\, b_1+b_5X_5+ b_6X_6 + b_7X_7 + e$ --------- (2) is called the odds.

Thus, $\log\left\{\frac{P}{1-P}\right\}$ is called the log odds or logit. The classification procedure is as follows if $\log\left\{\frac{P}{1-P}\right\}$ tends to zero, we classify the individual farmer as belonging to group 1 (low access), and if $\log\left\{\frac{P}{1-P}\right\}$ tends to one, we classify the individual farmers as belonging to group II (high access). The classification boundary will then be the locus of points where $a+b_1X_1 +b_2X_2b_1 + b_3X_3+ b_4X_4b_1+b_5X_5 +b_6X_6 +b_7X_7 = 0.5$.

The logit score, $\log\left\{\frac{P}{1-P}\right\}$ is estimated by the use of Maximum Likelihood Estimate (MLE) procedure. The logit coefficient b's are estimated by solving simultaneous equations using algebraic matrix form.

Product Moment Correlation Coefficient (r) was used to analyze hypothesis two (there is no significant relationship between farmers access to extension services and impacts on household welfare). The correlation coefficient measures linear association between interval variables (Okwuokenye and Urhibo, 2019). Okwuokenye and Urhibo (2019) further explained that the coefficient can take a value between -1 to +1. When "r" = +1, it means that there is a perfect linear relationship between X (farmers access to extension services) and Y (imparts on household welfare). By implication, a unit increase in X (farmers access to extension services), will result to a constant increase in Y (imparts on household welfare). On the other hand, when "r" = -1, it implies that there is a perfect inverse relationship between X and Y. By interpretation, a unit increase in X would result to a unit decrease or reduction in Y. Going further, when "r" = 0, it means no relationship exist between X and Y. The computation of Product Moment Correlation Coefficient is specified as:

$r = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{}$

$\sqrt{[\ n\Sigma X^2 - (\Sigma X)^2]\ [n\Sigma Y^2 - (\Sigma Y)^2]}$ ---------- (2)

In decision rule, the Product Moment Correlation produces coefficient estimates (X) and standard errors (E). Where the standard error of the independent variable (X) is smaller than half of the value of the parameter estimates of the variable, we conclude that the estimate of the variable is statistically significant. In that case we accept the alternative hypothesis, indicating significant relationship between X and Y while the null is rejected.

RESULTS AND DISCUSSION

Personal characteristics of farmers

The personal characteristics of the farmers' are shown in Table 1. The results revealed that most (65.96%) of the farmers were males while the other farmers (34.04%) were females. It simply implies that farming in the area is dominated by the males. This scenario may not be unconnected to the fact that many of the residents are headed by male households. Male dominance amongst farmers in the study area was confirmed by findings of Ndanitsa *et al.* (2021). The marital status of the farmers showed that most (67.38%) of the farmers were married, 14.89% were single, about 11.35% were divorced while few (6.38%) were widow(er). The result was skewed towards married farmers. The result indicated that the farmers are responsible people. The result agreed with that of Mairabo (2021) who stated that married people dominated farming activities around the Nigerian environment and perhaps seen as a source family labour to the farmers. Age of the respondents revealed that, most (43.26%) of the farmers were between the age bracket of 30 – 39 years. About 17.73%, 17.02%, 14.89% and 7.09% respectively belong to less than 30 years, 40 – 49 years, 50 – 59 years and 60 years and above. The average age of the farmers was 40.04 years and this implies that they are in their active age and strong for the farm work. The result aligns with findings of Ndanitsa *et al.* (2021) who reported similar age range of farmers amongst Nigerian farmers.

Majority (38.29%) of the farmers had secondary education, close to this was 34.04% that had primary school education. On the other side, few of them (19.14%) had no formal education while about 8.51% had post-secondary education. The result shows that a good fraction of the farmers are literates and so can apply extension agent's innovation with little or no assistance. This result is in consonance with findings of Ahmadu *et al.* (2021) that revealed the dominance of farming business by literate farmers. The average household size of the farmers was 7 persons, with most (36.88%) of them having between 7 – 9 persons in their households. About 39.01% and 24.01% respectively had less than 7 persons and more than 9 persons in their households. The implication of the result is that the respondents have people to cater for and who in return can serve as a source of farm labour to them. Findings of Ahmadu *et al.* (2021) were in agreement with this result, believing that they have people to cater for and can assist them also in farm work.

The average farming experience of the farmers was 10.78 years, with most (45.39%) of them having farming experience of 13 years and above. About 27.66%, 15.60% and 11.35% respectively had 9 – 12 years, 5 – 8 years and 1 – 4 years farming experience. From the result, it could be inferred that the farmers are well experienced in their farming activities. Such experience will go a long way in help to improve their farming practice and maximize their production. Okwuokenye and Okoh (2018) findings is in line with this result and they asserted that good farming experience will enable them to be well positioned to solve farm issues for greater productivity. The farm size of the farmers revealed that most (50.35%) of the respondents had farm size of between 1 – 3 ha. About 14.18% had less than 1 ha while about 35.46% farm on land that is more than 3ha. The average farm size was 3.23 ha and this implies that a good proportion of the farmers are scale-scale farmers since they farm on land that is less than 4ha. The findings of Garba *et al.* (2021) concurred with this result that describes majority of Nigeria farmers as small-scale farmers.

In terms of being cooperative members, the result showed that most (86.52%) of the farmers are members of one cooperative society or the other. The other fraction (13.48%) indicated that they do not belong to cooperative society. Having most of the farmers belonging to cooperative group is an indication that there are benefits that are farm related that are being derived. Akpomedaye (2023) findings agreed with this result as they revealed that farmers participation in cooperative societies earn them some benefits which enhances their farming activities and more access to extension services. In where credit provision is concerned, most (82.27%) of the farmers agreed that they have collected credit from the group that they belong. Few (17.73%) indicated that they have not collected credit from any group. Receiving credit perhaps stand out as one of the major reasons why they choose to belong to cooperative societies. This result conforms with that of Sogo-Temi and Olubiyo (2004) who asserted that provision of agricultural credit is an important determinant of agricultural production and growth. This also has a way of relating with access to extension services.

Rate of farmers' access to extension services

The rate of farmers' access to extension services is shown in Table 2. The result revealed that the rate of access of the farmers to extension services and the packages they offer to the farmers is such that, most of the farmers, numbering 64 (45.39%) indicated that their access of agricultural extension agents services was high. About 25 of them (17.73%) noted that their access was very high, 33 of the farmers (23.40%) indicated that they were only average in their access to extension services while very few of them, numbering 19 (13.48%) indicated that their own access level was low. The result suggests that the access level of the farmers to extension services was high and sufficient to keep them informed with current trends of improved agricultural technologies that are capable of increasing their farm output. The result simply implies that the extension agents are meeting up with their responsibilities. Ayenew *et al.*, (2020) results agreed with this finding. They found an increasing access of farmers to agricultural

extension agents which increases the rate of adoption of improved technology and consequently, their output.

Impacts of farmers access to extension services on technology adoption

The impacts of access of farmers to extension services farmers on adoption of technology are shown in Table 3. From the results, first among the impacts of farmers access of extension services which was accepted by the farmers as haven made impact include: access to extension service has helped to guide against losses in the farm (53.91%), increase in yield of farmers (51.77%) and increase in farm income resulting to farmers welfare (51.77%). Other major impacts were: access to farm inputs (51.77%) and access to credit (51.77%), enhanced quality of produce (51.77%) and Information on processing of products (51.77%). The result implies that farmers access to extension services which has facilitated the adoption of the technology offered by the extension packages has really made several impacts on the farmers farming activities, farm output, farm income and welfare. These results are supported by findings of Anang *et al.,* (2020) which noted that agricultural extension services had a significant effect on farmers output, farm income and welfare.

Strategies that could improve extension service access to farmers

Results in Table 4 show agreed strategies that are capable of improving the rate of access of farmers to extension services to include: improving on farmers educational level (mean = 4.31), members of farmers social group (mean = 4.31), training of farmers (mean = 4.11), increase in number of extension staff (mean = 4.10) and provision of incentives to the extension agents (mean = 4.02). Employing on farmers access to extension services through educational level as a strategy was agreed by the findings of Ndanitsa *et al.* (2021) that education helps to ease farmers willingness to adopt innovations which ultimately ought to have come been accessed before usage. Being members of one social group or the other was also agreed by Ndanitsa *et al.* (2021) that it exposes the farmers to one another where ideas are shared and farm issues are resolved. The authors also reiterated that membership of social groups makes it possible for the farmers to be easily reached by the extension agents. Training of farmers was agreed as a strategy to accessibility of extension services by Declaro-Ruedas (2019) who acknowledged training and visit system as a modality to transfer technology. Increase in the number of the extension staff is in line with the Kristin *et al.* (2019) who stated that it will reduce the extension-farmer ratio and therefore makes it possible for farmers to be easily reached by the extension workers. While provision of incentives to extension staff was in agreement with findings of Ozioko, *et al.* (2022). Such incentives perhaps involve paying of salaries and allowances when due as it is hoped that doing this may go a long way in motivating the extension staff in their jobs and as well making themselves and their technology more available to the farmers.

The management of farm information and communication technologies for the purpose of extension work (mean = 3.81), establishing a functional and effective linkages between the farmers and the extension agents (mean = 3.62), provision of adequate logistics for the extension

agents (mean = 3.53) provision of inputs for the extension agents to use in training the farmers (mean = 3.41) and cost of the inputs and the process (mean = 3.34). Results on the management of farm information and communication technologies for the purpose of extension work, provision of adequate logistics for the extension agents and provision of inputs for the extension agents to use in training the farmers were supported by the findings of Olorunfemi *et al.* (2020) as the authors acknowledged that such provisions will increase the extension workers motivation and as well boost their capacity, all of which will make them readily available and extend their technology to the farmers. The establishment of a functional and effective linkages between the farmers and the extension agents was corroborated by Owusu *et al.* (2020) who suggested that the strategy will improve the functional effectiveness of extension agents in making themselves accessible to farmers. Cost of the inputs and the process of accessing the extension agents is another determinant of farmers access to extension agents and the improved technology.

Relationship between farmers personal characteristics and rate of access to extension services

The personal characteristics of the farmers were considered in determining the factors influencing the rate of access to extension services. Table 5 shows the Ordered Logit Model (OLM) was used to analyse the factors and it revealed that the Chi-Squared value was 69.84 and it depicts a high level of significant likelihood ratio statistics ($P<0.01$) and this indicates a large variation in the personal characteristics of farmers on rate of access to extension services. The R^2 was 62.50% explains the variation in the farmers personal characteristics on access to extension services. Nine farmers personal characteristics namely: gender, age, level of education, marital status, household size, farm size, farming experience, cooperative membership, and farm income were analyzed, and out of which gender, age, level of education, household size, cooperative membership and farm income were significant variables to farmers rate of access to extension services.

Gender of the respondents had a beta coefficient of 9.491 with a standard error (SE) of 3.802. The relationship with rate of access to extension services was positive and significant at the 5% level. Since male constituted the majority (65.96%) (see Table 1), it therefore implies that the more males we have in farming, the more rate of access they would have with extension services. Male farmers are mostly head of their households and going by the African tradition, they are more disposed to the public and social life. Based on this assertion, they have more access to extension services. The odd ratio was 2.021 which thus indicates that the involvement of more males in farming will double the rate of access of the farmers to extension services. This result is supported by Mulwa *et al.* (2017) who reported that male farmers are found to accept or take-up more agricultural technologies that have been exposed to from extension agents. The age of the farmers and the rate of their access to extension services was negatively related and significant at the 1% level. The beta coefficient was -11.478 while the SE was -3.861. The negative relationship implies that younger farmers are likely to have higher rate of access to extension services than their younger counterparts. The odd ratio of 2.331 is an indication that younger

farmers due to their vibrancy will be able to access extension services two times more than their older counterparts. The finding of Abdallah and Awal (2016) is in line with this result as they noted that age of household head has negative effect on farmers decision to seek and use agricultural extension services.

The relationship of farmers educational with access to extension services respectively had a beta coefficient and SE of 4.216 and 0.129. The relationship was positive and significant at the 1% level. Impliedly, more educated farmers will have higher rate of access to extension services. The odd ratio of 3.018 indicates that more educated farmers will access extension services three times more than their illiterate counterparts. Kiprotich *et al.* (2019) found a positive relationship between years of formal education and demand and use of agricultural supports services and therefore underscores this result. Household size of the farmers had a positive and significant relationship with the rate of access to extension services. The beta coefficient (1.805) and SE (0.107) were significant at the 5% level. The result therefore implies that farmers with larger households are likely to have a higher rate of access to extension services when compared with farmers with smaller households. The odd ratio of 2.641 implies that increase in household size will correspondingly result to about three times increase in their rate of access to extension services. Findings of Togba *et al.* (2022) agreed with this result as they asserted that large household size demands more quantity of food which will make them demand and use more extension services in order to maximize their farm output and meet up with their food demands. Cooperative membership of the farmers and rate of their access to extension services were positively related and significant at the 5% level. The beta coefficient was 1.716 while the SE was 0.029. The result simply means that being members of cooperative society will increase the rate at which they will have access to extension services. The odd ratio was 2.962, indicating of the fact that farmers who are members of cooperative societies will be able to access extension services at a rate of about three times much more than other counterparts who are non-members. Similar result was obtained by Ngango and Hong (2021) which revealed a positive influence of membership of farm organizations and the rate of access to farm innovations and adoption. The provision of credit to the farmers (b = 7.439; SE = 2.665) is positively and significantly related at the 5% level to the rate of farmers access to extension services. The positive relationship implies that farmers with higher incomes are more likely to seek the demand for extension services. Going by the odd ratio (2.34), an increase in farmers income will result to about two times increase in their rate of access to extension services. This result concurs with Abate *et al.* (2014) who found that income generated from farm sales had a positive effect on rate of access to extension services.

Relationship of farmers access to extension services and impacts on household welfare

The relationship between farmers access to extension services and its impacts on household welfare (hypothesis 2) was analyzed using the Product Moment Correlation Coefficient. This analytical technique was used to determine the statistical significance of variable X, which is

access to extension services on variable Y, which is impacts on household welfare. Table 6 revealed the results as shown below:

The parameter estimates of variable, X (access to extension services) is 0.8371, while the standard error of the same variable is 0.2261. The Product Moment Correlation Coefficient, 'R' is 0.8723. The value of 'R^2' implies that there is a positive and strong linear relationship between access to extension services and impacts on household welfare. This mean that the farmers will steadily be updated with the latest farm technologies which will help to improve their farm output and income.

In conclusion, since half of the value of the parameter estimate of variable X (0.4186) which is access to extension services (obtained as 0.8371 / 2 = 0.4186) is greater than the standard error of variable X (0.2261), it implies that there is a statistical significance of access to extension services and impacts on household welfare. Against this background, the null hypothesis was rejected in favour of the alternative. It thus states that: Farmers access to extension services significantly impacts on household welfare. Findings of Anang *et al.,* (2020) supported this result as they found that agricultural extension services had a statistically significant effect on household welfare.

CONCLUSION

The farmers rate of access to extension services was high and this translated to impacting very positively on the farmers yield, income and household welfare. There is still room or potentials for more access of farmers to extension services which would go further to better their household welfare. Since personal characteristics like gender, age, educational level, household size, membership of cooperative societies and farm income have significant relationship with farmer rate of access to extension services, it therefore implies that an improvement on these characteristics will help to increase the farmers output, income and household welfare.

Based on findings of the study, it was recommended that, though extension service access by the farmers was high, there is still need to privatize, if not all but some sensitive aspects of the extension service system that could help to better the farmers output, income and welfare. Compatibility of extension agents technology needs to be improved through enlightenment on how they can make their technologies more compatible with the farmers culture, norms and tradition. Doing this will improve on the rate of farmers accessibility and adoption of extension technology which consequently will improve on farm income and welfare. Farm size was not a significant factor to rate of accessibility of farmers to extension agents services. Farmers, especially those with larger farmers need to be encouraged to improve on their rate of access of extension services so that their income will not only be improved but will also help to guarantee food security in the nation.

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APPENDICES

Table 1: Socio-economic characteristics of the farmer's

Characteristics	**Category**	**Freq.**	**Percentage**	Mean
Gender	Male	93	65.96	
	Female	48	34.04	
Marital Status	Single	21	14.89	
	Married	95	67.38	
	Divorced	16	11.35	
	Widow(er)	9	6.38	
Age (years)	< 30	25	17.73	
	30 – 39	61	43.26	
	40 – 49	24	17.02	
	50 – 59	21	14.89	
	60 & above	10	7.09	40.04 years
Educational Status	No formal educ.	27	19.14	
	Primary educ.	48	34.04	
	Secondary educ.	54	38.29	
	Post-secondary educ.	12	8.51	
House hold size	1 – 3	19	13.48	
	4 – 6	36	25.53	
	7 – 9	52	36.88	
	10 – 12	26	18.44	
	➢ 12	8	5.67	7
Farming exp.	1 – 4	16	11.35	
	5 – 8	22	15.60	
	9 – 12	39	27.66	
	13 & above	64	45.39	10.8
Farm size (ha)	< 1	20	14.18	
	1 – 3	71	50.35	
	4 – 6	32	22.69	
	7 & above	18	12.77	3.23
Membership of cooperative society	Yes	122	86.52	
	No	19	13.48	
Credit access	Yes	116	82.27	
	No	25	17.73	

Source: Field survey, 2023; N=141

Table 2: Rate of farmers access to extension services

s/n	Rate of farmer access to extension services	Frequency	Percentage
1.	Very high	25	17.73
2.	High	64	45.39
3.	Average	33	23.40
4.	Low	19	13.48

Source: Field survey, 2023

Table 3: Impacts of access to extension services on technology adoption by farmers

Impacts of access of farmers to extension services	**Insignificant**	**Minor**	**Moderate**	**Major**	**Remark**
- Help to guide against losses in the farm	11 (7.80%)	21 (14.89%)	33 (23.40%)	76 (53.91%)	Accepted
- Increase in yield of Farmers	19 (13.48%)	23 (16.31%)	26 (18.44%)	73 (51.77%)	Accepted
- Increase in farm income resulting to farmers welfare	14 (9.93%)	23 (16.31%)	31 (21.99%)	73 (51.77%)	Accepted
- Access to farm inputs	22 (15.60%)	28 (19.86%)	22 (15.60%)	72 (51.06%)	Accepted
- Access to credit	13 (9.23%)	24 (17.02%)	32 (22.69%)	72 (51.06%)	Accepted
- Enhanced quality of Produce	12 (8.51%)	19 (13.48%)	38 (26.95%)	72 (51.06%)	Accepted
- Information on processing of products	13 (9.22%)	21 (14.89%)	34 (24.11%)	73 (51.77%)	Accepted
-Information on packaging and distribution of produce	41 (29.08%)	22 (15.60%)	34 (24.11%)	44 (31.21%)	Rejected
- Increase in production cost	27 (19.15%)	34 (24.11%)	59 (41.84%)	21 (14.89%)	Rejected

Source: Field survey, 2023

Table 4: Strategies that could improve extension service access to farmers

Strategies	Mean	Standard Dev.	Remark
- Improving on farmers educational level	4.31*	0.54	Accepted
- Members of farmers social group	4.31*	0.61	Accepted
- Training of farmers	4.11*	0.61	Accepted
- Increase in number of extension staff	4.10*	0.66	Accepted
- Provision of incentives to the extension agents	4.02*	0.69	Accepted
- Management of farm information and communication technologies for the purpose of extension work	3.81*	0.64	Accepted
- Establishing a functional and effective linkages between the farmers and the extension agents	3.62*	0.71	Accepted
- Provision of adequate logistics for the extension Agents	3.53*	0.74	Accepted
- Provision of inputs for the extension agents to use in training the farmers	3.41*	0.79	Accepted
- Cost of the inputs and the process	3.34*	0.81	Accepted
- Privatizing extension services	2.52	0.75	Rejected
- Compatibility of the extension agents technology	2.19	0.79	Rejected
- Land ownership system	1.46	0.83	Rejected
- Religious differences	1.20	0.86	Rejected

** Agreed = mean ≥ 3.0; Source: Field survey, 2023*

Table 5: Relationship between socio-economic characteristics of farmers and rate of adoption of improved farm technologies

Variables	B – Coefficient	Standard Error	t-ratio	Odd-ratio
Constant	29.415	11.6223	3.91	
Gender	9.491	3.802	2.33*	2.021
Age (years)	-11.478	-3.861	3.12**	2.331
Level of educ.	4.216	0.129	1.52**	3.018
Marital status	1.032	0.826	1.082	0.921
Household size	1.805	0.107	0.01*	2.641
Farm size	5.491	3.472	2.33	1.324
Farm experience	2.839	1.977	1.83	1.116
Cooperative membership	1.716	0.029	1.21*	2.962
Farm income	7.439	2.665	2.37*	2.34
R^2 =	0.625			
Chi-square	69.84*			
Df	9			
P < 0.05				

*Source: field survey, 2023; *Significant at the 5% prob. level; **Significant at the 1% prob. Level*

Table 6: Parameter estimates of access to extension services and impacts on household welfare

Variable	Parameter estimates
Parameter estimate of variable X (access to extension services)	0.8371
Standard error of variable X (access to extension services)	0.2261
'R' (Product Moment Correlation Coefficient)	0.8723
Half of the Parameter Estimate of Variable, X (access to extension services)	0.4186

Source: Field survey, 2023