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UTILIZATION AND PROFITABILITY OF GOOD AGRICULTURAL PRACTICES ON MAIZE FARMERS IN ONDO STATE, NIGERIA

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ABSTRACT
The study is designed to determine the utilization and profitability of good agricultural practices (GAP) programme on maize farmers in Ondo State, Nigeria. The primary data used in the study were collected with the aid of structured questionnaire and multi-stage sampling procedure to select 240 respondents. Descriptive statistics, budgeting technique, and binary logistic regression model were major statistical tools employed to achieve the specific objectives and a four-point Likert-type scale was used to analyze the degree of utilization of the GAP programme practices in the study area. Findings showed that farmers under the utilized GAP programme had a mean profit of ₦55,300.33 (US$ 145.53). Further analysis showed a benefit-cost ratio (2.46) of the profitability of the GAP. The logistic regression revealed that age of maize farmer, level of education, extension contact, farm size, monthly income and training experience were the major determinants influencing the utilization of the GAP programme in the study area. The study concluded that the utilization of GAP programme by maize farmers contributed substantially to the profitability of their business. It was therefore, recommended that effective general extension services should be extended to the study area to intensify the use of GAP introduced technologies by farmers for maize production.

Keywords: Good Agricultural Practices, Logit regression, Maize farmers, Net farm income, Profitability, Utilization.

INTRODUCTION
Maize (*Zea mays* **L.**) belongs to the family Poaceae, is one of the primary cereal grains farmed globally. Maize can grow in a variety of conditions. Maize is primarily used as a food source, but it is also used as fodder and is the most important raw ingredient for animal feed such as silage (Chaudhary *et al.*, 2014; Muluneh, 2019).

The primary source of maize, which comes in a variety of cultivars, is Central America and Mexico (Perales and Golicher, 2014; Ranum *et al.*, 2014). It was also brought to West African nations by the Portuguese, and it is most widely known in Benin, Ghana, and Nigeria. According to various studies, maize was a significant crop in Mexico around 5000 years ago. The United States has the most maize crop land, followed by Brazil, China, Mexico, and India. In terms of production, the United States is first, followed by China (Ranum *et al.*, 2014).

Maize is acknowledged as the "queen of cereals" because of its high demand and adaptability (Kumari *et al.*, 2018; Kanojia *et al.*, 2020). In terms of acreage and output, it is the world's second most significant cereal crop (Majeed, 2020). In the year 2016–2017, global maize production was around 1040 million MT, with the United States and China contributing about 38 and 23 percent, respectively (Kanojia *et al.*,2020). Nigeria is the world's 11th largest maize grower and Africa's second largest producer after South Africa (Karimov *et al.,* 2014).

Maize is the most significant grain crop in sub-Saharan Africa and a staple diet for over 1.2 billion people in the region (Muluneh, 2019). Maize is the primary food crop for more than 300 million Africans. Food and non-food products can be made from any part of the crop. Maize is also consumed as a vegetable and it is rich in dietary fiber and other nutrients (Olaniyan, 2015). Maize accounts for 30–50% of low-income African household expenses. Maize accounts for more than 30% of people's caloric consumption in Sub-Saharan Africa. As a result, numerous African countries that rely on maize as a primary food crop have implemented agricultural strategies to ensure a consistent supply of the commodity by increasing crop production and productivity (Conceicao *et al.,* 2016).

Maize is grown in practically all of Nigeria's agro-ecological zones (Egbetokun *et al.,* 2014). It is also an important cereal crop that has largely supplanted sorghum in many areas, not only because of the number of farmers who produce it, but also because of its economic importance, International Institute of Tropical Agriculture (IITA, 2001). Maize output has increased in recent years, but it is still insufficient to fulfill the demands of a growing population. As a result, technical agronomic methods are required to make up for the deficiency.

Maize farmers, particularly in Nigeria, face a variety of challenges, including abiotic and biotic stresses, poor soil fertility, pest and disease attacks, lack of access to key inputs (especially quality seed and fertilizers), low levels of mechanization, poor post-harvest management, and shortfalls due to border closures, forex bans, and lockdowns due to the coronavirus pandemic (Olaniyan, 2015). Furthermore, by not following optimal practices in maize farming, yields are decreased. This setback has lingered for years, causing farmers to be disappointed and discouraged from starting maize production, resulting in a grain scarcity across the country.

Various governments, however, have considered the massive production. Productivity must be raised to achieve maize self-sufficiency and fulfill present and future demand for maize output. Therefore, this study introduced the concept of German International Cooperation GIZ' Green Innovation Centre for the Agriculture and Food sector (GIAE) that had embarked on training in Ondo State on the Good Agricultural Practice (GAP) programme for maize farmers so as to stabilized the maize yield in the study area. The GAP has created a positive impact through its efforts to improve the effectiveness of national agricultural extension systems to provide smallholder farmers with a range of appropriate technological options and knowledge along agricultural value-chain. It has been achieved by building capacity and creating stronger links between research and extension and then to farmers. The GAP implements a value-chain extension approach through its thematic areas as described thus; promotes productivity-enhancing technologies including fertilizer, improved varieties, climate smart production technologies and other good agricultural practices, promotes value-adding technologies in the areas of postharvest handling, storages and agro-processing, supports improved access for input (improved seeds and fertilizer) and creating linkages for output market for farming communities (Greeninnovation-Nigeria, 2019).

The green innovation center of Nigeria uses its GAP as thorough method of cultivation, which is applied for on-farm production and post-production processes to increase yield and income of smallholder farmers. It was developed in partnership with researchers and farmers within each specific cropping zone while taking into account social, environmental, sustainability money management skills. GAP is promoted in the four-value chain of rice, maize, cassava and Irish potato. The GAP training takes on a practical approach delivered on demo-plots by well-trained Agricultural Development Programme (ADP) extension agents in each state that is involved. Farmers meet regularly during the cropping cycle to ensure that they receive right information at the right time. Handbooks and picture blocks are used for the training. In addition, 3D animated video reinforces the learning (Greeninnovation-Nigeria 2019).

Against this background, the present study was therefore motivated to determine the utilization and profitability of Good Agricultural Practices (GAP) programme on maize farmers in Ondo State, Nigeria. The specific Objectives were to: (i) analyze the utilization of technologies and innovative skills disseminated through the programme; and (ii) evaluates the profitability of maize farmers after utilized the GAP training. Hypothesis to be tested was Ho_1: there is no significant relationship between the utilization of GAP programme and selected factors.

MATERIALS AND METHODS

The Study Area

The study was conducted in Ondo State of Nigeria, between August and November, 2019. This was considered on the effects of GAP after implementation from 2017-2019. Ondo State is one of the 36 states in Nigeria and was carved out of the old Western region on the 3rd of February, 1976. The state is made up of 18 Local Government Areas (LGAs) with a projected population of 4.6 million inhabitants (National Bureau of Statistics [NBS], 2017). It is bounded in the north by Ekiti and Kogi States, in the east by Edo State, in the southeast by Delta state, in the west by Osun and Ogun states and in the south by the Bight of Benin of the Atlantic Ocean (Fatusin *et al.*, 2019).

The State lies between longitudes 4° 301 and 6° 001 East of the Greenwich Meridian and latitudes 5° 451 and 8° 151 North of the equator. The land area is about 14,793,186 square kilometers with varying physical features like hills, lowland, rivers creeks and lagoons (Owoeye, 2017).

The favourable geographical location and climatic condition make the State a veritable agricultural zone for the cultivation of maize. The farmers in the State grow food and other cash crops for both domestic consumption and export. Other crops grown include cashew, cassava, palm produce, coffee, yam, timber, citrus, plantain, soya beans, cowpea and kolanut (Oke *et al.*, 2020).

Sampling Techniques and Sample Size

The target population of this study was maize farmers that participated in GAP training for full maize production cycle and utilized the programme' activities till the time of the study. The research made use of multi-stage sampling procedure. The first stage involved the purposive selection of four LGAs (Akure North, Owo, Ondo East and Odigbo) out of the 18 LGAs in Ondo State which are predominant in maize production and of where GAP based programme has been fully utilized in each of the four LGAs. In each of these LGAs, three communities were randomly selected, and then, 20 GAP maize-based farmers were also selected randomly from each community, thereby making a total of 240 respondents that were selected and used for the study. Relevant information on the specific objectives of the study was collected with the aid of structured questionnaire and interview schedule. In addition, the veracity of the data was checked through focus group discussions (FGD), especially information on farmers' income, expenditure and qualitative data from the GAP maize farmers.

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Analytical Techniques

This study used descriptive statistics to summarize the socioeconomic characteristics of respondents, budgeting technique was employed to evaluate the profitability. Binary logistic regression was used to identify factors influencing utilization of GAP training by smallholder maize farmers in the study areas.

The profitability of maize production was estimated using the budgeting technique. The budgeting technique involves the deduction of the total variable costs (Naira) from the total revenue of dried maize grains (Naira) to obtain the gross margin for each maize farmer in selected local government areas. The total variable costs of production are the cost of labor, fertilizers, agro-chemicals, inputs and other miscellaneous expenses. The expression is given as:

$$\mathrm{GM_i} = \sum_{n=1}^{n} \mathrm{P_i Y_i} - \mathrm{C_i} \qquad \ldots(1)$$

where;

GM_i = Gross margin of farm i measured in Naira, P_i = Farm gate price in Naira per kg of dried maize grains of farm i, Y_i = Total quantity in kg of dried maize grains of farm I; C_i = Total variable costs incurred on farm i in Naira, n = Total number of maize farms.

From equation 1, P_1Y_1 = Total revenue (TR) and C_1 = Total variable cost (TVC); therefore,

$$\mathrm{TC = TVC + TFC} \qquad \ldots(2)$$

where;

TFC = Total fixed cost

$$\text{Net income (NI)} = \mathrm{TR - TC} \qquad \ldots(3)$$

$$\text{Benefit cost ratio (BCR)} = \frac{\sum TR}{\sum TC} \qquad \ldots(4)$$

Enterprise is profitable if BCR> 1, BCR< 1, it is not profitable and if BCR = 1, means break-even.

The binary logistic regression was used to examine the relationship between selected factors affecting the utilization of GAP programme. Based on the comparative advantages associated with the use of binary logit model, we then follow Gujarati (2003) which is generally written as:

$$\mathrm{In}\left(\frac{\mathrm{P}}{1-\mathrm{P}}\right) = \mathrm{Y^*}_{\mathrm{i}} = \frac{1}{1+exp^{-(\beta_0+\beta_i X_i+\varepsilon_i)}} \qquad \ldots(5)$$

where;

Y^*_i = latent dependent variable

$\ln\left(\frac{P}{1-\mathrm{P}}\right)$ = Log of odds ratio of utilization/non-utilization.

In = natural logarithm.

P_i = Probability of utilizing introduced GAP' technologies.

1-P = Probability of not utilising introduced GAP' technologies.

β_i = column vector of unknown parameters to be estimated,

β_0 = constant,

X_i = a row vector of explanatory variables

The reduced form of equation (2) can be rewritten as:

$$Y_i^* = \beta_0 + \sum_{k=1}^{J} \beta_j X_i + \varepsilon_i, \quad \begin{cases} if\ J > 0, & Y_i^* = 1 \\ otherwise & Y_i^* = 0 \end{cases} \qquad \ldots(6)$$

$\mathcal{E}_i$ = vector of unobserved random effect.

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The dependent variable and independent variables used in this study are presented in Table 1. Data collected from the field survey were analyzed on IBM SPSS version 23.0

Table 1: Measurement of Dependent and Independent Variables

Variable	Definition	Measurement	*apriori* signs
		Dependent Variable	
GAP	Degree of utilization	Not Utilized (NU), Slightly Utilized (SU), Moderately Utilized (MU) and Highly Utilized (HU) to justify their assessment.	
		Independent variable	
X_1	Age	Measured as actual age of respondent in years and scale down to interval level	-
X_2	Sex	Male = 1, female = 0	+/-
X_3	Marital status	Single = 1, married = 2 divorced = 3, widowed = 4, separated = 5.	+/-
X_4	Level of education	No Formal Education =1, Primary Education =2, Secondary Education =3, Tertiary Education = 4 at ordinal level.	+
X_5	Household size	Number of persons living under the same roof and scale down to interval level	+
X_6	Access to extension services	Yes= 1, Otherwise = 0	+
X_7	Farm size	Farmland under maize cultivation measured in hectare (Ha) and scale down to interval level	+
X_8	Monthly income	Measured as net sales of dried maize grains realized annually in Nigeria currency (₦)	+
X_9	Training experience	Training received from various intervention for years	+/-

Note: GAP = Good Agricultural Practices

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

Results on Table 2 show that 53.8 % of the GAP maize farmers were within 50-59 years with mean age of 54.9 years. This is similar to the findings of Owoeye (2017) that reported that maize farmers in Ondo State were relatively old (more than 50 years) with the mean age of 54.8 years. Thus, 56.7 % of the respondents were male and 84.1 % of the GAP maize farmers were married. However, 41.9 % of GAP maize farmers had primary school education while 36.9 % had secondary education.

In addition, about 61.7 % have household sizes that range within 6-10 people with a mean household of 8 people. This signifies that the households are moderately large in size, which could serve as a source of family labor (Garner and Campos, 2014). Access to extension services remains a challenge, as 65.8 % of GAP maize farmers did not have access to regularly general agricultural extension services. Furthermore, the results indicate that a significant proportion (52.5%) of the GAP maize farmers fell within the range of ₦100,001 – ₦200,000. Also, 87.5 % of GAP maize farmers had their farm size ranging from 1 to 2.5 hectares which implies that our respondents are mainly of small-scale category. Nonetheless, 68.4% of the GAP maize farmers had received long enough training experience in their occupation which ought to have made them good maize farmers.

Table 2: Socio-economic Characteristics of GAP Maize Farmers (n = 240)

Characteristics	Categories	Percentage
Age	50-59 years old (Mean = 54.9)	53.8
Sex	Male	56.7
Marital Status	Married	84.1
Level of education	Secondary	36.9
	Primary	41.9
Access to agricultural extension services	No Access	65.8
Household size	6-10 (Mean = 7)	61.7
Farm size (ha)	1-2.5 (Mean =1.8)	87.5
Monthly income (₦)	100,001 – 200,000 (Mean = ₦145,156.73)	52.5
Years of training experience	Above 2 years (Mean = 2.65)	75.0

Note: ₦ 380 = 1US$
Source: Field survey, 2019

Cost and Returns Analysis

The results of the budgeting analysis for GAP maize farmers are presented in Table 3. It could be seen that the total revenue from maize output were found to be ₦22,332,600 for the respondents per maize production cycle. The total variable cost incurred was ₦7,610,207, the gross margin of the maize farmers was ₦14,722,383, while the net farm income of ₦13,272,079 was realized. A higher net farm income is realized among maize farmers as a result of technological and innovative skill acquired from GAP programme.

Generally, the profitability levels using the Net Farm Income is ₦13,272,079 (US$34,926.52) with each GAP maize farmer gained an average mean net farm income profit of ₦55,300.33 (US$ 145.53). However, each maize farmer spent ₦183 as a unit cost to produce 1 kg of dried maize grains at the rate of ₦450.Thus, the study found out that the business of maize production is a profitable venture with the intervention of Good Agricultural Practices programme.

The benefit-cost ratio (BCR) computed showed greater than 1 which further indicates that maize farming is profitable. In terms of sustainable profitability realized by the maize farmers, it is the result of utilizing post training activities of GAP technologies that motivated the maize farmers to continue in the business.

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Table 3: Cost and Returns of Respondents

Items	**GAP (n = 240)**
Maize grains output or yield (kg) yr^{-1}	49,628
Price (₦) kg^{-1}	450
A. Total Revenue (₦)	22,332,600
B. Expenses	(₦)
Fixed cost	1,450,314
Variable costs	
Buy quality seed	1,001,450
Buy insecticides	3,365,225
Buy mineral fertilizer	1,568,775
Maize Bags	250,345
Labour	
Land & soil preparation	450,000
Sowing	195,000
Thinning and weeding	25,500
Application of Insecticides	78,150
Application of Fertilizers	55,000
Harvesting of dried maize	360,000
Shelling and drying	164,667
Treatment of grains before Storage	30,450
Bagging and Storage of maize grains	65,645
Total Variable Cost	7,610,207
Total costs (TFC+TVC)	9,060,521
Gross Margin (TR– TVC)	14,722,383
Net Farm Income (A – B)	13,272,079
Unit Cost (₦Kg^{-1}), expenses/yield	183
Mean profit of gross margin	61,343.26
Mean profit of net farm income	55,300.33
Benefit cost ratio (BCR) = TR/TC	2.46

*Note: ₦ 380 = 1US$
Source: Field survey, 2019

Utilization of Technologies of GAP Post Training Activities

The grand mean of 3.13 was reported in Table 4; therefore, the mean value equal or greater than the grand mean is considered "high utilization and otherwise is considered "low utilization". Those technologies that are highly utilized thus are safe use of pesticides which was highly utilized by 77.5% of the respondents with mean value of ($\overline{X}$ = 3.78). With this, GAP maize farmers could now use only pesticides approved by National Agency for Food and Drugs Administration and Control (NAFDAC), their plants would be on good health and give good harvest, they would wear always protective clothes, masks, rain boots, helmets and google glasses, read the labels of the pesticides to know the correct dosage and utilization and they ensured there would be no danger for their family, particularly their children and their environment through safe use of pesticides after participating in GAP training. In addition, pegging and sowing in lines was highly utilized by 75.0% of the respondents with mean value of ($\overline{X}$ =3.65), during FGD, the maize farmers claimed that pegging and sowing in lines makes easier all other works in their farms. Also, 1st and 2nd weeding and heaping were highly utilized ($\overline{X}$ =3.54), according to GAP' maize farmers, first weeding and heaping usually done 3 to 4 weeks after sowing to avoid weeds that could steal the water and the nutrients which soil gives to their planted maize, and the heaping is done to allow water to stay around the plant and helps the young maize plant to resist drought and wind. Second weeding and heaping is done when they noticed weeds begin to reappear on their fields and maize cobs become visible. This signifies that their fields are very clean and maize cobs grow well and have an easy and bountiful harvest.

Table 4: Utilization of GAP's Technologies after Participation by Maize Farmers (n = 240)

Technologies	**Not utilized F**	**Slightly utilized F**	**Moderately utilized F**	**Highly utilized F**	**Mean $\bar{X}$**	**Ranks**
Safe use of pesticides	0 (0.0)	0 (0.0)	54 (22.5)	186 (77.5)	3.78	1st
Pegging and sowing in lines	0 (0.0)	24 (10.0)	36 (15.0)	180 (75.0)	3.65	2nd
1st and 2nd weeding and heaping	4(1.7)	15 (6.3)	69 (28.7)	152 (63.3)	3.54	3rd
Units to know and choice of good plot of land	4(1.7)	15 (6.2)	114 (47.5)	107 (44.6)	3.53	4th
Thinning and supplying replanting	0 (0.0)	16 (6.7)	83 (34.6)	141 (58.7)	3.52	5th
Land preparation	18 (7.5)	39 (16.3)	57 (23.7)	126 (52.5)	3.21	6th
Choosing and sourcing good quality seed	21 (8.8)	30 (12.5)	72 (30.0)	117 (48.7)	3.18	7th
Cropping calendar	24 (10.0)	45 (18.8)	36 (15.0)	135 (56.2)	3.18	7th
Harvest of dry maize	0(0.0)	15 (6.2)	168 (70.0)	57 (23.8)	3.18	7th
Application of insecticides	12 (5.0)	15 (6.3)	132 (55.0)	81 (33.7)	3.18	7th
Buying mineral fertilizer and other chemicals	21 (8.8)	39 (16.2)	72 (30.0)	108 (45.0)	3.11	11th
Dry maize and storage of maize grains	0 (0.0)	81 (33.8)	51 (21.2)	108 (45.0)	3.11	11th
Selling maize, saving after sales and managing money daily.	0 (0.0)	81 (33.8)	51 (21.2)	108 (45.0)	3.11	11th
Treatment with insecticides before storage of dried maize	24 (10.0)	63 (26.3)	117 (48.7)	36 (15.0)	2.69	14th
Dosage of mineral fertilizer NPK 15:15:15 at first application	27 (11.3)	162 (67.5)	45 (18.7)	6 (2.5)	2.13	15th
Dosage of urea at second application	49 (20.4)	155 (64.6)	25 (10.4)	11 (4.6)	1.99	16th

Note: Grand means: 3.13; figures in parenthesis are percentages
Source: Field survey, 2019

Conversely, GAP technical technologies that have low utilization thus are correct dosage of urea (with 4 g per seed hole) at second application ($\overline{X}$ =1.99) which is done 9 weeks after sowing when the maize starts to flower to get big and well filled maize cobs, but it is only 64.6% (Table 4) of the respondents that were slightly utilized the technology. Moreover, correct dosage of mineral fertilizer NPK 15:15:15 (with 8g per seed hole) at first application ($\overline{X}$ = 2.13) which is done 10 days after planting to facilitate the growth and development of healthy plants, but they were using the technology at lower degree as 67.5% of the respondents slightly utilized the technology. With the low utilization of the correct dosage of fertilizer application, many GAP maize farmers would have wastage of fertilizer and fertilizer is expensive. Furthermore, treatment with insecticides before storage of dried maize ($\overline{X}$ = 2.69) which is done with storage insecticides like Acetelic (primophos methyl) powder and Phostoxin tablet to protected against pests and insects attack before and after putting maize cobs in the cribs or silos as information generated during FGD has low utilization.

Results of the Binary Logistic Regression for the Utilization of GAP Approach

Results in Table 5 show the parameter estimates and odds ratio estimated of socio-economic variables influencing the utilization of introduced GAP programme using a stepwise logistic regression method. The F-statistics with a value of 84.73 at $p<0.01$ shows the goodness of fit of the model on the utilization of GAP programme. The Pseudo R-squares for the model is 0.764. These value 76.4% implied the proportion of variation in the utilization of GAP programme, that was explained by all variables fitted into the model using maximum likelihood estimation method (MLE) in the logistic regression model while the remaining 23.6% is embedded in the error term. To further confirm the suitability of using logit model in this study, the Hosmer and Lemeshow test for the model (GAP model) was not violated because the p-value is greater than 5% probability level. Interpretation of findings in this study is based on their odds ratios since coefficient of logit model cannot be interpreted directly (Gujarati, 2003).

The logit result shows that there is a negative and significant ($p<0.01$) relationship between the age of maize farmers and the level of utilization of GAP. This result is consistent with our *a priori* expectation as well as with the existing literature that older farmers are risk averse and have little interest in long term investment compared to young farmers. The odds ratio for GAP is less than one (0.73) which implies that an addition of one year to the age of maize farmers, farmers are less likely to utilize GAP. It also reveals that a one-year increase in farmer's age, the odds of utilizing GAP approach will decrease by 27% compared to the odds of younger farmers. Younger farmers have longer horizons than older farmers and hence are more willing to accept innovation. This result is consistent with the findings of (Mafimisebi *et al.,* 2006; Gedikoglu, 2015) that younger one is more receptive to modern ideas than older ones.

Furthermore, the positive and significant ($p<0.01$) relationship between utilization of GAP programme and the farmer's level of education is expected, this is because education promotes utilization of innovation. It is believed that educated farmers will utilize progressive new technologies with a view to enhancing their maize production. The odds ratio is greater than one which indicates that for every additional one year a maize farmer spends in schooling, the odds of utilizing GAP approach on maize production increases by 1.12 times higher than the odds of a farmer that is not educated. Our result supports the finding of Oduro-Ofori *et al.* (2014) that as the *educational* level of farmers increases, the *output* of agricultural productivity of farmers increases.

Moreover, extension service has a positive and significant ($p<0.01$) relationship with utilization of technologies introduced by GAP programme. This finding reflects the dependability of farmers on agricultural extension workers on information that are related to GAP. A unit increase in the number of visitations to the farmers by the extension worker, farmers will be more likely to embrace GAP packages. Similarly, odds ratio for utilizing GAP training is 1.12 and by extension this means that the odds of using GAP method on maize farm will increase the odds of its acceptance by 1.12 times the odds of farmers without access to extension services in the study area.

Thus, farm size cultivated also has a positive and significant ($p< 0.05$) relationship with utilization of GAP programme. This implies that as the area of land cultivated of maize increases, utilization of GAP increases. The coefficient of farm size is 0.26 with the corresponding odds ratio of 1.26. The odds ratio is greater than one. The positive sign for this variable is theoretically and consistently agreed with the study *a priori* expectation. This implies that farmers with large scale of maize production are more likely to utilize GAP programme compared with farmers that have small-sized farmlands. The result indicates that increasing farm size by a unit, *ceteris paribus*, the odds of utilization of GAP programme will increase by 26 % compare to non-users.

In addition, monthly income was significant ($p<0.01$) and had positive relationship with utilization of GAP programme. The result here agrees with *a priori* expectation that the higher the income of a farmer, the higher the utilization of GAP programme. The probability of utilizing GAP training increases by 55 % compared to the odds of a non-user of the training.

Nonetheless, training experience was also significant ($p<0.05$) but had a negative relationship with GAP. This is not consistent with our a priori expectation. This indicates that as training experience of farmer increases, his level of utilization of GAP programme decreases. Long years of training experience are expected to encourage utilization of new technology among respondents. However, the corresponding odd ratio is 1.08, which implies that utilization of GAP packages will increase by 1.08 times higher than a non-user.

Table 5: Empirical Results of the Binary Logistic Regression Model

	GAP approach		
Variable	**Coeff.**	**Z.**	**Exp(β)**
Constant	1.12	9.41***	1.98
Age of respondent	-0.28	-5.71***	0.73
Level of education	0.12	5.17***	1.12
Household size	-0.11	-0.48	0.81
Extension contact	0.14	7.78***	1.12
Farm size	0.26	7.03**	1.26
Monthly income	0.17	5.00***	1.55
Training experience	-0.12	-3.76**	1.08
Model fit summary			
F-statistics	84. 73***		
% Correct classification	78.0		
McFadden' s Pseudo R^2	0.764		

GAP: 2Log likelihood:^{2}= 63.10***, Hosmer and Lemeshowtest: = χ^2 = 6.69 P = 0.347,
***, **, * Sig. at 1%, 5% and 10%, respectively.
Source: Field survey, 2019

CONCLUSION AND RECOMMENDATIONS

In conclusion, GAP programme enhanced maize farmers with a range of appropriate technological options and knowledge along agricultural value-added, and thus increased their utilization and profitability. The fact that profit of farmers involved in GAP was increased, support the notion that technical know-how is not enough for farmers, but the transformation of this to profitability of agro-business. The following recommendations were made based on the findings:

1. Since low utilization occurred on some introduced technologies of GAP programme. There is a need to re-launch awareness about them in educating the farmers, hence motivate them for efficient and effective operation and sustainability of the programme in the study area.
2. Effective general extension services should be extended to the study area to intensify the use of GAP introduced practices by farmers for maize production.

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