# Agricultural Training and Livelihood Outcomes: Opinion of Farmers in Mezam Division in the North West Region of Cameroon

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**DOI: https://dx.doi.org/10.47772/IJRISS.2024.802077**

**Received: 24 January 2024; Accepted: 12 February 2024; Published: 11 March 2024**

## ABSTRACT

The objective of this study is to analyse the effect of agricultural training on livelihood outcomes of farmers in Mezam Division in the North West region of Cameroon. The data was elicited via a structured questionnaire administered on a sample of 381 farmers. Using cluster sampling approach, proximity villages were grouped into three clusters of Bamenda I, Bamenda II and Bamenda III, representing the 3 sub divisions in Mezam division in the North West region of Cameroon. Stratified random sampling was then used to select farmers to participate in the study. Data was analysed using ordinary least square and control function regression estimation techniques with altercation. The result revealed that agricultural training has a negative effect on the livelihood of farmers, due to factors such as lack of adoption of new farming method, inadequate training programs, and seminars, unsustainable practices such as usage of insecticides, pesticides and chemical fertilizers. Based on the findings, it is recommended to carry out a detailed study to find out why this negative relationship between agricultural training and livelihood outcomes exist. Qualitative approaches such as focus group discussion and in-depth interviews will provide the expected insights.

**Keywords:** Agricultural Training, farmers, Livelihood Outcomes, Control Function Regression

## INTRODUCTION

In many emerging nations, agriculture remains a cornerstone of rural households' livelihoods, contributing significantly to income generation (Royster & Kirsch, 2012). Approximately 2.5 billion people worldwide, 60% of them residing in developing nations, rely predominantly on agriculture, with over half of the world's food supply produced in small farms (FAO, 2020). In Cameroon for instance, the livelihoods of 2.75 million families directly hinge on agriculture, with six million adults, representing two out of every five individuals, earning their livelihood through farming. Agriculture contributed about 17% to Cameroon's GDP between 2021 and 2022, making it the second major contributor, after the service sector and industry, in increasing order of importance (O'neill, 2023). Enhancing innovative agricultural approaches can therefore have significant effects on livelihoods and the economy of Cameroon.

Agricultural training and technology adoption can potentially influence the livelihoods of farmers and the eventual contribution to the GDP (Ngochembo et al., 2022). This probably explains why capacity building through agricultural training, and adoption of agricultural innovations continue to occupy central places in the livelihood discourses of farmers and the rural community (Adato & Meinzen-Dick, 2002). By tackling the issues of livelihood, the issues of poverty, unemployment, poor health and sanitary conditions will be redressed (Balgah et al., 2023). Halim and Ali (1997) defined agricultural training as a process of acquiring specific skills to perform an agricultural activity better. This definition is prescriptive and does not include explaining the exact skills that farmers need to acquire to become more productive. Diab et al. (2020) construe agricultural training as the process of teaching, informing, or educating farmers so that they may become qualified in their farming activities, and they become qualified to perform in positions of greater difficulty and responsibility.

According to Mgendi et al. (2022), an agricultural training program is a series of formal and informal, a short-or long-term educational activities that is prepared for an individual or group of farmers to achieve defined objectives Whether formal or informal, agricultural training interventions are designed to facilitate knowledge or skill transfers on specific agricultural issues supposed to benefit farmers. The training content might not necessarily be new to farmers, as they can also focus on why technologies have not been adopted. Agricultural training therefore provides a range of educational activities with the primary aim of achieving human resource development throughout the rural economies of almost all nations (Yang et al., 2021). Agricultural training can therefore influence the livelihoods of participants.

The concept livelihoods has been consistent in the rural and agricultural development debates, since it was consolidated in the 1990s. Livelihood consists of assets (stores, resources, claims and access), capabilities and activities essential to everyday life that are conducted over one's life span (Naj et al., 2011; Scoones, 2015; Ibrahim et al., 2018). Sustainability of livelihood is achieved when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets while not undermining the natural resource base (Scoones, 2009). Based on the sustainable livelihood paradigm (Chambers & Conway, 1992; Scoones, 2015), the livelihood assets of farmers encompass natural, financial, human, physical, and social assets. Agricultural training can contribute to improving the livelihoods of farmers. The multifaceted nature of the concept makes it difficult for all components to be analysed in one study. In the context of the study, a farmer's livelihood comprises five dimensions, which are social capital, physical capital, natural capital, and financial capitals.

Agricultural training has been carried out by different organizations in the North West region of Cameroon as a means to improve the livelihood of farmers. Unfortunately, coordinated effort to analyse the effects of agricultural training on farmers' livelihoods is largely missing. To bridge this knowledge gap, this study seeks to analyse the effect of agricultural training on farmers' livelihood in Mezam Division in the North West region of Cameroon.

The main objective of the study is to analyse the effect of agricultural training on farmers' livelihoods in Mezam Division in the North West region of Cameroon.

The following central hypothesis is tested in the Study:

Agricultural training significantly affects farmers' livelihood outcomes in the Mezam Division

**A review of the impact of Agricultural training on farmers' livelihoods**

Various studies have examined the relationship between agricultural training and farmers' livelihoods in different contexts. Abia *et al.* (2016) for instance investigated the contribution of agricultural farm services and agricultural training on tomato farmers' livelihood in Plateau State, in Nigeria using purposive sampling approach to select the participants and OLS approach to document for the estimates. The data was obtained from the questionnaires administered to participant from the local government area. Result obtained revealed that agricultural training has a significant effect on the livelihood of the farmers. The sampling techniques were purposive in nature. It was established that rural livelihood outcomes pertaining to crop and livestock production, household income, asset ownership and fertiliser use were significantly improved by this innovations. The study can be criticized on the sampling techniques, as multi stage sampling was initially introduced as one of the methods used, but the study failed to indicate how the multi stage sampling approach was carried out. The estimate used in the study cannot be trusted because of the OLS estimation technique use in the paper cannot handle the issue of reverse causality which was eminent, though the author did not acknowledge it. Therefore, there is need for more robust approach (Abia et al., 2016).

Mapila *et al.* (2012) researched on how farming innovations and interventions systems affect the livelihood of the rural population in Malawi. The methodology involves localities that benefited from agricultural training, using those which did not as control. The intervention effect was to be evaluated on the two localities chosen for the study which revealed that farm innovation was an important determinant of farmer's livelihood. The study however failed to present how the limitations of the logistic regression model was overcome, thereby making its findings questionable (Mapila et al., 2012).Ainslie, (2005) examined the present contribution of small scale agriculture training to rural livelihood in north-west Peddie district and the four factors identified by Lipton (1996) as being essential for small scale farming to flourish, were analysed by making use of data obtained in two recent studies conducted in the area. The two studies, which both used a questionnaire survey for data collection, enabled a comparison between dry land and irrigated agriculture. The analysis showed that agriculture adds to rural livelihood in a modest way only, and hardly ever constituted the main source of household income. For the majority of households in both the dryland and irrigated production environments the main source of income consisted of State transfers of which pensions were the most important. In the area, three of the four factors identified by Lipton (1996), namely access to agricultural land, research and development of appropriate technology, and rural infrastructure were found to require reform for local small scale farming to become a viable livelihood option. The only factor which did not appear to present a major constraint was access to markets. Relative to the present level of production, the market in the rural area itself is sufficiently large to absorb most produce, usually at prices higher than those offered by formal markets. In future, access to markets could become a constraint if production by small scale farmers were to be increased significantly (Ainslie, 2005).

In another study, Pamuk and Van Rijn (2019) investigated the rate of the diversity in new platforms in farming networks. Moreover, the researchers carried out their research in the sub-Sahara locality in Africa. The study made use of the survey research design. Results revealed that innovation platforms implemented according to the integrated agricultural research for developmental approach principles were better at promoting networks of households with other farmers within villages. Innovation platforms with more active members were more successful in promoting agricultural technologies, while innovation platforms with many different stakeholders were less successful in promoting agricultural technology. However, the two researchers acknowledge that their approach is likely fragile to errors and they requested a robust method which involve getting information using the strategy of a constant supervision and implementation.

Human capital theory proposed by Becker and Mincer in the early 1960s was used in this study. They argued that skills, knowledge, experience, habits and personality are very important productive tools. The theory was based on the following tenets. Firstly, it assumes that human capital is the intangible economic value of a worker's experience and skills. The assumption makes intuitive sense in the context of the study because experience and skills are indispensable inputs as far as agricultural training is concerned. The assumption failed to indicate the dimension of the skill set. However, it indicates factors such as education, training, intelligence, skills, health, and other things employers value such as loyalty and punctuality. The human capital theory posits that human beings can increase their productive capacity through greater education and skills training. Critics of the theory argue that it is flawed, overly simplistic, and confounds labour with capital (Becker, 1994)

Most of the studies in the literature relied only on a single question item in capturing agricultural training and livelihood outcomes of farmers. For Instance, Abia *et al.,* (2016) investigated the contribution of agricultural farm services and agricultural training on tomato farmers' livelihood in Plateau State, Nigeria using a purposive sampling approach to select the participants and the OLS approach to document the estimates, but the model relied on a single question items. Considering that the variable agricultural training and farmer livelihood are multiple-faceted measuring it using only one aspect may be biased as most of the relevant facets may be left out. To overcome this challenge, the study will take into consideration all the facets of training skills to cope with climate change in agriculture, knowledge acquired from training as well as all the five pillars of livelihoods. The concepts will be measured by constructing an index.

The estimation techniques used in most of the studies failed to account for the possibility of reverse causation between agricultural training and livelihood outcomes. The study will rely on the 2SLS instrumental variable regression and control function estimation techniques to account for both the internal and external endogeneity in the model.

Another gap identified in the literature, none of the studies have analysed the concept of agricultural training, gender inclusion and farmer's livelihood as a study. The issue of gender inclusion is not well documented in the literature. The study will close the gap by providing more insight into the effect of gender inclusion on farmers' livelihood outcomes.

The literature review on "Agricultural Training, Gender Inclusion, and Farmers' Livelihood in Mezam Division, North West Region of Cameroon" encompasses a multitude of studies investigating the empirical linkage between agricultural training and farmers' livelihood outcomes. A notable study by (Abia et al., 2016) focused on tomato farmers in Nigeria, employing a purposive sampling approach and OLS estimation to assess the impact of agricultural farm services and training on livelihoods. However, criticisms include an inadequate explanation of the multi-stage sampling method and the potential bias introduced by using OLS, indicating the need for a more robust approach. Other studies, such as (Mapila et al., 2012) in Malawi and (Pamuk & Van Rijn, 2019) in sub-Saharan Africa, explored the effects of farming innovations and diversity in farming networks on rural livelihoods. Limitations in these studies include inadequacies in handling logistic regression model limitations and potential errors in survey research design.

## MATERIAL AND METHODS

The data used in this study was obtained from the survey questionnaire administered on the sample of 381 farmers. Using cluster sampling approach, proximity villages were grouped into three clusters sub-divisions (Bamenda I, II and III). Stratified random sampling was then used to selected farmers to participate in the study. The sampling frame was provided by the government extension worker in each subdivision. These selected farmers were chosen by extension officers. All the names of farmers in each cluster were written on pieces of paper and put in a bucket and the extension worker randomly selected 127 farmers from each cluster to participate in the survey of 381 farmers. Data was collected via a structured questionnaire by the researcher and three other trained farmers. This was done only after the questionnaire had been pre-tested on 10 beneficiaries of agricultural training in each cluster, and the instrument modified accordingly. Multiple correspondence analyses were used to model the relationship between agricultural training and farmers' livelihood outcome since it deal with binary data. Ordinary least Square technique with control function was used to achieve the objective.

### Model Specification

It has been documented in the literature that, in Sub-Saharan Africa, rural poverty accounts for 90% of total

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue II February 2024

poverty in the region, and approximately 80% of the poor still depend on agriculture for their livelihoods (Dixon et al., 2001). Agricultural training is a means of acquiring a new expanded set of skills necessary for ameliorating output and wealth and employment creation among farming communities (Dabson, 2011; Díaz-Pichardo et al., 2014; Karlsson et al., 2010). This study adopts the approach provided by Díaz-Pichardo et al. (2014) and Karlsson et al. (2010). Both agricultural training, also known as agripreneurship, and farmers' livelihood are multifaceted concepts that can be better captured using several indicators using the multi-correspondence analysis. In order to construct the agricultural training index and farmer's livelihood outcomes, multiple corresponding analyses (MCA) was employed since MCA is designed to model relationships between binary categorical variables in terms of mass and inertia. Since most of the indicators in this study are binary, MCA is most appropriate for the aggregation procedure (Salawu et al., 2022). The indexes will be generated using the formula below. It is assumed that t is designated agricultural training axis or dimension, and is the composite index value generated. The mathematical exposition for the index is given by:

$$\boldsymbol{AGT}_i = \frac{\sum_{k=1}^{K}\sum_{jk=1}^{JK} w_{jk}^{k} I_{JK}^{K}}{K}$$

Where; $\mathbf{AGT_i}$ represents agricultural training index for all the dimensions or domains considered; K is the number of indicators; the discrete variables that the value 0 and 1 and JK is the number of categorical indicators k; I is the binary indicator corresponding to discrete variables JK; W is weight (score of the first standardized axis of categorical variable Jk). The index generated will produce both negative and positive values for the index, thus posing some interpretations difficulty. Therefore, it has to be normalised within the range of 0 to 1, though fractionalised and not binary. By so doing, we eliminate the negative values of the index by adjusting the scores within the range of 0 to 1. The mathematical expositions for the normalized index procedure are outlined below.;

$$\widetilde{\boldsymbol{AGT}}_i = \frac{(AGT - \text{r(min)})}{(\text{r(max)} - r(\text{min}))}$$

Where r(max) is the maximum value while r(min) is the minimum value of AGT scores. By the same token of appreciation and mathematical expositions, the farmer's livelihood outcomes index will be constructed similarly using the various binary indicators of farmer's livelihood outcomes. In addition, relying on a single question item on the questionnaires will be erroneous to capture all the facets of farmers' livelihood outcomes and agricultural training. The exogenous variable in this Objective is agricultural training, and the endogenous variable is farmers' livelihood in the Mezam division in the North West region of Cameroon. Therefore, the causal effect between agricultural training and farmer's livelihood shall be captured using the ordinary least square estimation technique. The model is specified thus:

$$\boldsymbol{FLO = \vartheta_1 + \vartheta_1 AGT + \vartheta_2 PEDU + \vartheta_3 SEDU + \vartheta_4 TEDU + \vartheta_5 X + \varepsilon_1} \qquad \mathbf{3.1}$$

FLO stands for farmers' livelihood outcomes and is an index computed using MCA and normalized; AGT represents the exogenous endogenous variable of agricultural training. There is the possibility of reverse causation between agricultural training and farmer's livelihood outcomes.

PEDU is a dummy variable for primary education; it takes the value 1 if the respondents have attended primary education 0 otherwise. SEDU and TEDU represent secondary and tertiary education, respectively, and are binary. X represents the vector of exogenous covariates used in fitting the model (Income, age, and years of experience of farmers). At the same time, $\varepsilon_1$ captured the idiosyncratic terms, which are other variables that can also affect farmers' livelihood outcomes. However, they are assumed to have a mean value of 0 and a standard deviation of 1. While v1, V2, V3, V4, and V3 are parameters to be estimated in the

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue II February 2024

farmers' livelihood outcomes function. V1 captured the magnitude of the effect of agricultural training on farmers' livelihoods. V1 can either be positive or negative. Education is expected to positively affect farmers' livelihood in the Mezam North West region of Cameroon.

However, estimation of the effect of agricultural training on farmers' livelihood outcomes using the ordinary least square, knowing that there is a strong possibility that agricultural training and farmer's livelihood outcomes are jointly and simultaneously determined and each has a ceteris paribus behavioural interpretation, will lead to bias estimates. The study adopts two-stage instrumental variable approaches to account for the endogeneity of agricultural training in the model. The appropriate instruments used in the first stage equation is years of agricultural training [YEXP] and proximity to the training institution [PTI], as these variables are assumed to have negligible or no effect on the farmer's livelihood outcomes. In the first stage, we estimated the reduced form equation of agricultural training as observed below:

$$AGT = \beta_0 + \beta_1 YEXP + \beta_2 PTI + \beta_2 PEDU + \beta_3 SEDU + \beta_4 TEDU + \beta_5 X + \varepsilon_2 \qquad 3.2$$

Equation 3.2 shows the relationship between the instruments (years of agricultural training experiences [YEXP] and proximity to agricultural training institutions [PTI], education, and another covariate on agricultural training. Where β represents a vector of parameters to be estimated using the OLS estimation techniques. The value of agricultural training [$\widehat{AGT}$] deduced from the reduced form equation ofagricultural training will be used in the second equation to address the issues of internal endogeneity inequation 3.1. Equation 3.1 is modified, as observed below:

$$FLO = \vartheta_1 + \vartheta_1 \widehat{AGT} + \vartheta_2 PEDU + \vartheta_3 SEDU + \vartheta_4 TEDU + \vartheta_5 X + \varepsilon_3 \qquad 3.3$$

However, unobserved external factors may also account for endogeneity between agricultural training and farmer's livelihood outcomes. To address the issue of an unobservable variable that could bias the estimated coefficients, we included the residual of the reduced form equation of agricultural training and the interaction of the residual of agricultural training and agricultural training to account for the nonlinear heterogeneity bias. The control function is the methodology that can handle the inclusion of residuals and its interaction in accounting for endogeneity. The control function is best known for handling the issue of endogeneity and selectivity bias (see (Tambi & Atemnkeng, 2018). The control function will be used in its parsimonious form to account for external endogeneity and heterogeneity only, as indicated in the equation below.

$$FLO = \vartheta_1 + \vartheta_1 AGT + \vartheta_2 PEDU + \vartheta_3 SEDU + \vartheta_4 TEDU + \beta_0 \varepsilon_2 + \beta_1 \varepsilon_2 * AGT + \vartheta_5 X + \varepsilon_4 \qquad 3.4$$

Where ε2 is the fitted residual of agricultural training, derived from the reduced form linear model of agricultural training in equation 3.2; $\varepsilon_2$*AGT is the interaction effect of the residual of agricultural training and agricultural training; and $\varepsilon_4$ is the error term. The fitted residual of agricultural training controls for unobservable variables that are correlated with farmer's livelihood outcomes. The interaction term accounts for the effect of nonlinear interaction of unobservable variables with farmer's livelihood outcomes. If β estimates are statistically equal to zero following the t and F statistics, the structural parameters of the farmer's livelihood outcomes function can conveniently be estimated using OLS; otherwise control function becomes indispensable.

Table 3. 1: Description of the Variables

| Variable | Code | Description |
|---|---|---|
| **Dependent Variable** | — | — |
| Farmers livelihood outcomes | Flo | Continuous |

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue II February 2024

| | | |
|---|---|---|
| **Independent Variables** | — | — |
| Agricultural Training | Agt | Continuous |
| **Control Variables** | — | — |
| Index of Input Access | farm input access | Continuous |
| Marital status (1=married, 0 otherwise) | married | Binary |
| Gender (1=Female, 0 otherwise) | female | Binary |
| Education (1=no education, 0 otherwise) | noedu | Binary |
| Education (1=Primary education, 0 otherwise) | pedu | Binary |
| Education (1=Secondary education, 0 otherwise | Sedu | Binary |
| Education (1=Tertiary education, 0 otherwise) | Tedu | Binary |
| Membership (1= belong if member of farmers association, 0 otherwise) | funion | Binary |
| Farm ownership (1=yes, 0 otherwise) | fownership | Binary |
| Age of Households | age r | Continuous |
| **Control Function Variables** | — | — |
| Residual of Agricultural Training | Res | Continuous |
| Interaction of agricultural training residual and agricultural training | resi inter | Continuous |

Source: Compiled by the Author, 2023

## RESULTS AND DISCUSSION

Table 4. 1: Descriptive Statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Flo | 381 | .020 | 1.001 | -1.298 | 3.812 |
| Agt | 381 | .408 | .221 | 0 | 1 |
| farm input access | 381 | .701 | .459 | 0 | 1 |
| Married | 381 | .614 | .487 | 0 | 1 |
| Female | 381 | .42 | .494 | 0 | 1 |
| Pedu | 381 | .223 | .417 | 0 | 1 |
| Sedu | 381 | .257 | .438 | 0 | 1 |
| Tedu | 381 | .27 | .445 | 0 | 1 |
| Funion | 381 | .48 | .5 | 0 | 1 |
| Fownership | 381 | .866 | .341 | 0 | 1 |
| age r | 357 | 37.042 | 11.538 | 18 | 69 |
| Res | 357 | 0 | .2 | -.473 | .599 |
| resi inter | 357 | .04 | .109 | -.082 | .527 |
| Source: Computed by Author using STATA 14, 2023 | | | | | |

Table 4 shows the descriptive statistics for agricultural training (Agt), gender inclusion and farmers livelihood outcomes (FLO). On averagely, FLO has a mean of 0 with a standard deviation of 1.001, the index FLO is continuous and not binary, the score ranges from -1.298 to 3.812. If the distribution of farmers' livelihood outcomes is symmetric around the mean, it is possible for the mean to be zero. This means that on average, the outcomes for farmers are balanced or equally distributed between positive and negative values. Economic factors affecting farmers' livelihoods could contribute to this pattern. For example, if farmers are exposed to various external and uncontrollable factors such as market fluctuations or weather conditions, their income or profitability might fluctuate around the mean of zero. In some cases, government policies or subsidies intended to support farmers could lead to a mean of zero. If these interventions aim to equalize income or provide equal benefits to all farmers, it could result in an average outcome close to zero, with a certain level of variability represented by the standard deviation.

Moreover, agricultural training averagely has a mean of 0.408 and a standard deviation of 0.221. The dataset might include various agricultural training programs with different levels of effectiveness or coverage, leading to the observed standard deviation. The mean of 0.408 suggests that, on average, farmers have received some level of agricultural training but with varying degrees of exposure or quality. The standard deviation indicates that some farmers might not have had access to any training, contributing to the variability. Factors such as geographical location, socioeconomic status, or lack of awareness can influence farmers' access to training opportunities.

Furthermore, farm inputs access consists of a large mean of 0.701 and a standard deviation of 0.459. The mean of 0.701 suggests that, on average, farmers have relatively good access to farm inputs such as seeds, fertilizers, or machinery. However, the standard deviation signifies a variability in access, indicating that some farmers may have better or more limited access to these resources. Factors influencing access such as proximity to markets, availability of credit, or government support programs can affect farmers' access to farm inputs. Differences in infrastructure, local policies, or seasonal variations can also contribute to the observed standard deviation.

Also, an averagely married person has a mean of 0.614 and a standard deviation of 0.487 than unmarried persons, this finding indicates some level of social cohesion. More so, it is relevant to know that marital status is a responsibility and stability at individual and community level. Married individuals may be more likely to have grown up in a family with a farming background and continue the tradition.

Additionally, an average female has a mean of 0.42 and a standard deviation of 0.494 than males. This finding indicates that both female & male farmers were well represented. Balance of opinions is necessary to reduce opinion disparity bias in the study. It further shows that female farmers are more represented than male counterpart in farmers' organization in the North West region.

More so, for educational qualification, tertiary education has contributed the highest mean, which is 0.270 and a standard deviation of 0.445, this was followed by secondary education with a mean of 0.257 and a standard deviation of 0.438. This statistics explains that among the farmer's in Mezam most of the farmers are educated persons with tertiary and secondary education; this was also the reason why we have mostly youths 30 to 40 years toping in farming organizations, many have learned advance technical skills which can improve agriculture and while those with primary education has the lowest mean which is 0.223 and standard deviation of 0.417 this might be because of the inadequate technical skills needed in farming.

Further, Members of farmers union have a mean of 0.48 and a corresponding standard deviation of 0.5, this results indicates that the standard deviation of 0.5 suggests that there is considerable variability in the membership status of farmers within the Mezam division. Some farmers may be actively involved in farmers' associations or cooperative, while others may not be members at all. However, factors influencing membership such as awareness of the benefits of union membership, regional or local factors, or differing attitudes towards collective action might contribute to the observed variability in union membership.

In addition, farm ownership possesses a mean of 0.866 and a standard deviation of 0.341, this implies that there is high ownership rate that is the mean of 0.866 indicates that a large majority of farmers within Mezam own their farms. This suggests a relatively high rate of farm ownership. Also, small variation in

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue II February 2024

ownership that is the smaller standard deviation of 0.341 suggests that there is less variability in farm ownership within Mezam. This means that the majority of farmers in Mezam own their own farms, with only a few exceptions. Another view is that factors such as local inheritance traditions, land tenure systems, or government policies can influence the relatively high farm ownership rate and the lower variability observed in Mezam Division.

Furthermore, the Age ranges of farmers contain a mean of 37.042 and a standard deviation of 11.538 alongside a minimum of 18 years and maximum of 69 years. The mean age of 37.042 indicates the average age of the farmers in Mezam. The standard deviation of 11.538 suggests that there is a moderate spread or dispersion of ages among the farmers. The minimum age of 18 and the maximum age of 69 further substantiate this range. So, the observed variation in age can be attributed to several factors, including generational differences, agricultural labour dynamics, and socio-economic changes. Additionally, factors such as retirement age, access to education, or cultural norms can influence the age range and distribution.

Table 4. 2: Pairwise correlations

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) flo | 1.000 | | | | | | | | | | | | |
| (2) agt | 0.287 | 1.000 | | | | | | | | | | | |
| | (0.000) | | | | | | | | | | | | |
| (3) farm_input_access | -0.233 | -0.282 | 1.000 | | | | | | | | | | |
| | (0.000) | (0.000) | | | | | | | | | | | |
| (4) married | -0.175 | -0.016 | 0.106 | 1.000 | | | | | | | | | |
| | (0.001) | (0.761) | (0.038) | | | | | | | | | | |
| (5) female | 0.077 | 0.148 | -0.048 | -0.058 | 1.000 | | | | | | | | |
| | (0.136) | (0.004) | (0.351) | (0.262) | | | | | | | | | |
| (6) pedu | 0.036 | 0.073 | -0.008 | 0.075 | 0.170 | 1.000 | | | | | | | |
| | (0.488) | (0.157) | (0.879) | (0.144) | (0.001) | | | | | | | | |
| (7) sedu | -0.118 | 0.010 | -0.074 | -0.089 | -0.026 | -0.315 | 1.000 | | | | | | |
| | (0.021) | (0.849) | (0.147) | (0.084) | (0.610) | (0.000) | | | | | | | |
| (8) tedu | 0.228 | 0.020 | -0.157 | -0.173 | -0.051 | -0.326 | -0.358 | 1.000 | | | | | |
| | (0.000) | (0.701) | (0.002) | (0.001) | (0.321) | (0.000) | (0.000) | | | | | | |
| (9) funion | -0.258 | -0.380 | 0.387 | 0.222 | -0.243 | 0.002 | -0.061 | -0.148 | 1.000 | | | | |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.966) | (0.235) | (0.004) | | | | | |
| (10) fownership | -0.255 | -0.136 | 0.315 | 0.211 | 0.022 | 0.081 | 0.073 | -0.281 | 0.239 | 1.000 | | | |
| | (0.000) | (0.008) | (0.000) | (0.000) | (0.667) | (0.114) | (0.157) | (0.000) | (0.000) | | | | |
| (11) age_r | -0.147 | -0.109 | 0.196 | 0.333 | -0.095 | -0.034 | -0.106 | -0.200 | 0.195 | 0.242 | 1.000 | | |
| | (0.005) | (0.039) | (0.000) | (0.000) | (0.074) | (0.522) | (0.046) | (0.000) | (0.000) | (0.000) | | | |
| (12) res | 0.179 | 0.894 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | |
| | (0.001) | (0.000) | (1.000) | (1.000) | (1.000) | (1.000) | (1.000) | (1.000) | (1.000) | (1.000) | (1.000) | | |
| (13) resi_inter | 0.175 | 0.803 | -0.023 | 0.023 | -0.022 | 0.016 | -0.009 | -0.002 | 0.014 | 0.036 | 0.004 | 0.901 | 1.000 |
| | (0.001) | (0.000) | (0.666) | (0.669) | (0.682) | (0.762) | (0.870) | (0.974) | (0.794) | (0.503) | (0.942) | (0.000) | |
| Source: Computed by Author using STATA 14, 2023 | | | | | | | | | | | | | |

The results in Table 4.6 shows that agricultural training, primary and tertiary educations are significantly and positively associated with farmers' livelihood outcome in the Mezam division. The results also revealed that access to farm inputs was significant, though negatively associated with farmers' livelihood outcome. Married and secondary level of education was also found to be significant However, the relationship was negative. Belong to an association was also found to be negatively related to farmers' livelihood outcome, though it was significant. The implication could be that, belonging to an association may not be translated to

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue II February 2024

a specific skill that can contribute positively to spur agricultural growth among the farmers. The control function variables were also found to be positively significantly associated with farmers' livelihood outcome. The level of correlation structure among the variables does not suggest possibility of multicolinearity. We proceeded to fitting the model

Table 4. 3: Results of model fitted

| | OLS) | (Reduced F) | (IV 2 SLS without Residual) | (Control Function) |
|---|---|---|---|---|
| VARIABLES | Flo | Agt | Flo | Flo |
| Agt | 0.877*** | — | 4.037** | 3.918** |
| | (0.284) | | (1.909) | (1.625) |
| Married | -0.232** | 0.0321 | -0.333** | -0.333*** |
| | (0.106) | (0.0230) | (0.143) | (0.118) |
| Female | -0.0240 | 0.0287 | -0.115 | -0.107 |
| | (0.102) | (0.0225) | (0.131) | (0.118) |
| Pedu | 0.00317 | 0.0214 | -0.0646 | -0.0654 |
| | (0.136) | (0.0325) | (0.194) | (0.152) |
| Sedu | -0.214* | -0.0125 | -0.175 | -0.175 |
| | (0.121) | (0.0332) | (0.154) | (0.116) |
| Tedu | 0.312** | -0.0290 | 0.403** | 0.397*** |
| | (0.142) | (0.0329) | (0.174) | (0.144) |
| Funion | -0.131 | -0.154*** | 0.357 | 0.336 |
| | (0.121) | (0.0241) | (0.359) | (0.295) |
| Fownership | -0.317 | -0.0250 | -0.238 | -0.255 |
| | (0.198) | (0.0354) | (0.224) | (0.208) |
| age_r | -0.000809 | -0.000647 | 0.00123 | 0.00123 |
| | (0.00451) | (0.00110) | (0.00591) | (0.00474) |
| Res | — | | — | -3.473** |
| | | | | (1.691) |
| resi_inter | — | | — | 0.875 |
| | | | | (1.160) |
| farm_input_access | -0.229* | -0.0725*** | — | — |
| | (0.118) | (0.0262) | | |
| Constant | 0.281 | 0.549*** | -1.452 | -1.416 |
| | (0.306) | (0.0563) | (1.047) | (0.883) |
| R2/(Pseudo –R2) | 0.203 | 0.201 | 0.212 | 0.205 |
| Partial R2(On excluded Instruments) | NA | NA | 7.90[1, 347: 0.0049] | NA |
| Joint F/ $\chi$ (p-value) test for Ho:Coefficients on instruments=0 | 7.13[10, 346: 0000] | 9.82[9, 347: 0000] | 7.68[1, 347: 0000] | 6.55[11, 345: 0000] |
| Underidentification test(Kleibergen-Paap rk LM statistic) | NA | NA | 7.68(0.0556) | NA |

| | | | | |
|---|---|---|---|---|
| Weak identification test(Cragg-Donald Wald F statistic) 10%maximal IV size | NA | NA | 7.65(16.38) | NA |
| Anderson-Rubin Wald tes | NA | NA | 5.78 [1, 347: 0.0167] | NA |
| Stock-Wright LM S statistic | NA | NA | 6.43 (0.0112] | NA |
| Endogeneity test | NA | NA | 3.958(0.0466) | NA |
| Observations | 357 | 357 | 357 | 357 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Computed by Author using STATA 14, 2023

The Results in Table 4.7 show that agricultural training has a significant negative effect on farmers' livelihood outcome for both the OLS, 2 SLS IV regression and the control function regression. The used of the OLS without control for the possibility of the reverse causation between agricultural training and farmers' livelihood outcome causes the coefficient of the variable to be inflated. After control for the endogeneity using the instrumental variable regression and control function the coefficient of agricultural training on farmers' livelihood outcome reduced to the tuned of 4.037 and 3.918 respectively. The significant of the effect of agricultural training on farmers' livelihood outcome permit us to reject the null hypothesis one of the study, which state that agricultural training has no significant effect on farmers' livelihood outcome.

The control function result also indicated that married is a significant predictor of farmers' livelihood outcome, though it was found to be negative. The implication is that those that are married may have other sources of livelihoods apart from the benefits they obtained from the farm compared to those that are not even married.

The finding as indicated from the control function model equally shows the tertiary level of education was significant and has a positive effect on farmers' livelihood outcome. The implication is that those farmers who have had tertiary education are into farming as a means of livelihoods and self-employment.

The residual of agricultural training was also found to be significant inputs in the farmers livelihood function. The significant of the residual is an indication that the endogeneity issue as a result of unobservable variables, which was assumed to be correlated with agricultural training have been successfully accounted for. The access to farm input was also found to be significant determinant of agricultural training in the reduced form equation. The significant of the access to farm input variable revealed that the instrument of agricultural training was valid and relevant. The post estimation of the two stage instrumental variable, shows strong evidence of adequate fit indices. As test of exogeneity of the variable, agricultural training was rejected. The Kleibergen-Paap rk LM statistic also indicates that instrument used was relevant and valid.

## CONCLUSION

The objective of the study was to determine the effect of agricultural training on farmers' livelihood outcomes in Mezam Division, in the North West region of Cameroon using ordinary least square regression, and pseudo control function with and without interaction. The result revealed that agriculture training has a negative significant effect on the livelihood of farmers' due to lack of adoption of new farming method, inadequate training programs, seminars, unsustainable practices such as usage of insecticides, pesticides and chemical fertilizers. Based on the finding this study recommends that policies directed towards agricultural training should be encouraged and more training centres created because its consequences on the livelihood of the farmers in terms of poor yield.

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