# *Original Research Article*

## Adoption of Sustainable Land Management Practices in Mbulu District, a Semiarid Area in North-Central Tanzania


**Abstract**

As an outcome of agricultural activities, land degradation has immense impacts on the environment and soil. It requires sustainable measures to combat the problem that is becoming critical. It awakens the demand for using sustainable land management practices. Despite many technological improvement programmes in agriculture, especially on land conservation, the adoption has remained low in many developing countries. This concern prompted this study to examine the factors influencing the adoption of SLMPs in the Mbulu district, a semiarid area in north-central Tanzania. A cross-sectional study was conducted, and data from 120 farmers were collected using semi-structured questionnaires. The adoption index was computed to establish the level of SLMP adoption. Also, probit regression analysis was employed in examining the factors influencing the adoption of the SMLPs in the study area. The findings show that the level of SLMP adoption was 19.2% in the study area, whereby 91.3% were male-headed households, and 8.7% were female-headed households' farmers. Probit regression results showed that gender, marital status, education, land size, and the distance to the extension office significantly influenced the adoption of SLMPs. Specifically, being male, a widow(er), having a formal education, owning a more extensive land size, and being closer to the extension office significantly increased the likelihood of SLMP adoption.

On the other hand, being unmarried and unaware of SLMPs reduced the probability of SLMP adoption. The average marginal effects analysis showed that increasing land size and distance from the extension office increased the likelihood of SLMP adoption while being male and having formal education had a minimal effect. Therefore, outreach and education efforts should target female farmers, those with lower levels of education, and those who are farther away from the source of information, the extension office, to increase adoption rates. Moreover, awareness-raising programmes need to be more targeted and effective to reach the intended audience. Additionally, programs that provide incentives to farmers with larger land sizes and those located closer to the extension office may be effectively utilised in promoting SLMP adoption.



**Keywords**: Sustainable land management practices; adoption; land degradation; semi-arid areas; agriculture

## 1.0 Introduction

Agriculture is the fundamental source of the food supply in all underdeveloped, developing, or even developed countries. Moreover, it is a source of income and employment for populations globally (Ivanov & Sokolova, 2018). Therefore, it is critical for transforming economies to reach development goals and achieve other essential pursuits. Agriculture's in-depth ties to the world economy, human communities, and biodiversity make it one of the most important aspects around the globe. However, even though agriculture is essential, it can hurt the land if it is not managed well. For example, it can lead to the loss of biodiversity and environmental damage in terms of soil fertility and land degradation (The Challenge of Feeding the World Sustainably, 2021).

Land degradation is the gradual loss or deterioration of a land's biological productivity, ecological sustainability, or human value (Olsson et al., 2019). Additionally, soil erosion, soil organic matter depletion, and land-use change linked to human and natural processes are all indicators of land degradation, according to Xie et al. (2020). Land degradation has become a global environmental problem and a significant obstacle to achieving goals for sustainable development and reducing poverty. Land degradation is caused, among other things, by land clearance, poor farming practices, overgrazing, poor irrigation, urban sprawl, commercial development, and land pollution, such as industrial waste and quarrying of stone, sand, and minerals (Eni, 2012). As a result, agriculture and the land may have a conflicting, win-lose, or win-win connection. For example, continued land use, like clearing forests to grow crops or raise animals, leads to degradation and a "win-lose" situation.

Land degradation has critical impacts on the environment, food security, distorted ecosystems, desertification, inadequate water supply, poor sanitation conditions, reduced water quality, soil erosion, and landslides (Devkota et al., 2015; Olsson et al., 2019; Xie et al., 2020; Mirzabaev et al., 2023; Zhao et al., 2023). The wide-ranging effects of land degradation have become a significant environmental problem that has gotten much attention worldwide. Because of this, many international, regional, and local goals have been set up to combat land degradation and bring it back to health. These are such as; United Nations' Sustainable Developments Goals (UN SDG, 2030), land degradation neutrality (LDN) in The UNCCD 2018–2030 Strategic Framework, the Comprehensive African Agricultural Development Programme (CAADP) in the Agenda 2063: The Africa We Want; the Tanzania Village Land Act, 1999; the Tanzania Forest Act, 2002. 83(7); the Tanzania Land Use Planning Act, 2007; the Tanzania Mining Act, 2010; and the Tanzania National Environmental Policy 2021. All these instruments target managing the environment to eliminate its detrimental effects. Furthermore, stakeholders' attention has been advocated when adopting reliable, sustainable land management measures relevant to tackling the problem.

Adopting sustainable land management practices (SLMPs) has become necessary to address the negative impact of land degradation. Sustainable land management measures are regarded as implementing land-use models that, via appropriate management techniques, allow land users to optimise economic and social gains from the land while conserving or increasing the ecological support functions of land resources (Henttonen et al., 2017). In addition, these measures aim to prevent agricultural or environmental disasters, as well as the adverse effects of climate change and, in particular, land degradation (Kauppi et al., 2014; Henttonen et al., 2017). Adopting sustainable land management practices is multifaceted, with several factors affecting land-use decisions and the practices adopted. Several studies on adopting SLMPs have been conducted, with land users either adopting them at a lower rate or not adopting them. The findings reveal that major influencing factors in the decision-making process of households towards various land conservation and management measures are age, household size, education level, and plot-level characteristics such as slope gradient and crop types (Babalola and Olayemi, 2013; Pingali et al., 2014; Belay et al., 2015; Haftu et al., 2019). In addition, mixed cropping, cover cropping, intercropping, mulching, and crop rotation (Aminu et al., 2019). Also, factors like farmers' age, land size, household size, years of schooling, extension service, farming experience, and technical know-how influence the adoption of land conservation and management practices (Kayode et al., 2017; Haftu et al., 2019).

Additionally, Adetomiwa et al. (2022) found that the adoption decision depends on factors like gender, marital status, farming experience, access to extension contacts, access to credit, and land ownership. Belachew et al. (2020) also found that age, sex, level of education, size of household, number of animals, size of land, access to credit, access to extension services, and training all affected adoption. In addition, Oduniyi et al. (2022) determined that farm input source, availability of farm inputs, extension frequency, water sources, and marital status, are vital for increasing awareness of adopting the SLMPs. Furthermore, Oduniyi (2022) revealed that gender, years of schooling, farming experience, extension visits, and social organisation membership all affect adopting the SLMPs. Moreover, Kirui (2017) determined that demographic and socioeconomic factors, including age and education level of the household head, family size, land size, membership in farmer cooperatives, savings and credit cooperatives, land tenure, access to credit, and proximity to markets, influenced the adoption of the SLMPs in East Africa.

Despite numerous international, regional, and local initiatives to promote communities' adoption of the SLMPs, developing countries still have a low adoption rate, especially in rural areas with low adoption of agriculture technologies (Hermans et al., 2021). Tanzania is no exception as a developing country. Considerable efforts to promote land conservation programs, the adoption of many recommended measures is minimal, and land degradation still accelerates (Kassie et al., 2013; Wickama et al., 2014).

Moreover, there is little empirical knowledge on the reasons for adopting sustainable land management practices, especially in the semiarid areas of Tanzania, hence the need for this study.

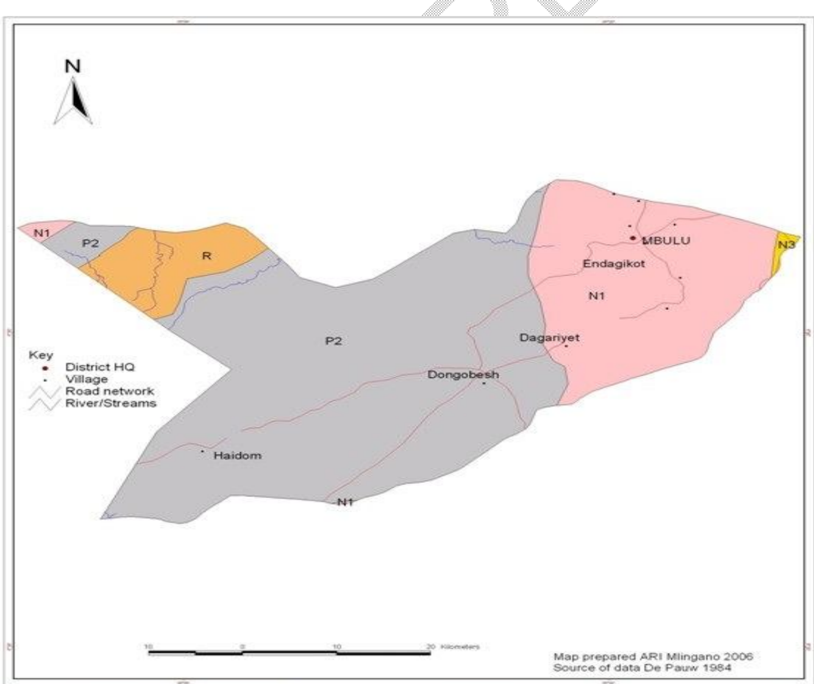
This study employs analytical techniques to examine the factors that influence adopting the sustainable SLMPs on agricultural activities in the Mbulu district, a semiarid area in North-Central Tanzania. As a result, this study adds new knowledge on the factors influencing the adoption of SLMPs in semiarid areas. In addition, this study provides insights to stakeholders on promoting efforts for LDN strategies achievement.

## 2.0 Materials and Methods

The study was conducted in the Mbulu district in the Manyara region, a central northern part of Tanzania. The area is comprised of five districts, and this is one of them. Karatu district borders it to the north, Babati district to the east, Hanang district to the south, and Iramba district to the west. The altitude of the district varies somewhere between 1000 and 2400 meters, and it is also located on the eastern side of the Mbulu Highlands. It is between thirty-four and thirty-five degrees east of Greenwich and three and four degrees south of the equator. The district was selected because it consists of both dry and semiarid zones. In addition, the indigenous people's lifestyle, which is characterised by sedentism and agropastoralist practices, disrupts the natural equilibrium of the environment, which makes the region more prone to soil degradation. The district is shown in Figure 1, indicating the agroecological zones.



**Figure 1: The map of Mbulu District in Northern Central Tanzania**




| Aez_code | Altitude(masl) | Rainfall(mm/year) | Physiography |
|---|---|---|---|
| N1 | 1500-2500 | 600 - 700 | Rolling to hilly, dissected plateaux developed on volcanic ash and lava |
| N3 | 900-1100 | 400 - 500 | Flat lacustrine plains with extensive salt and soda flats, inundated |
| P2 | 1100-1300 | 200 - 400 | Gently undulating plains mostly well drained developed on granites and gneisses |
| R | | Not applicable | Rocky terrain |

Source: Ministry of Agriculture, 2023

The study used a cross-sectional design. The approach was chosen because it allows researchers to compare diverse factors simultaneously. In this study, characteristics such as age, gender, education degree, marital status, and economic activities were explored in adopting sustainable land management practices. The study's target population was farmers, whereas the sampling unit was a farming household. The study used a multistage sampling approach. Mbulu district was purposively selected, followed by randomly selecting four villages from a list of wards. A systematic sampling procedure was employed in determining the respondents from a list of villages. This study employed a cross-sectional approach. The design was used for the research because it allows researchers to assess different variables simultaneously. Analogously, the investigation into the factors that influence adopting sustainable land management practices was conducted at a low cost. It focused on age, gender, educational level, marital status, the tenure system, land size, major economic activities, the slope of the terrain, and access to extension services.

The study used a sample size of 120 household heads involved in the data collection activity. Moreover, the close support of the Village Executive Officers facilitated the data collection exercise. Households were asked to complete semi-structured questionnaires, and regional and district environmental, livestock, and agricultural officers were interviewed in-depth. In addition, community and local leaders participated in focus group discussion sessions within the selected wards. Statistical Package for the Social Sciences (SPSS) software was used to manage datasets that could be analysed through the STATA software package.

Descriptive statistics analysed the dataset regarding percentages, frequency of the farming household characteristics and the adoption index of the SLMPs. Descriptive results provide a clear picture of the sample in the study area. On the other hand, the adoption index was computed to show the extent of adoption of the SLMPs among farmers in the study area.

The probit regression model estimated the influence of the factors for adopting sustainable land management practices in the study area. The model is a multivariate technique appropriate for a dichotomous dependent variable. Further, the model explains a dichotomous dependent variable with the empirical specification formulated as a latent-response variable. Furthermore, adopting sustainable land management practices took only two values to indicate whether a farmer uses sustainable land management practices. In the probit model, it is assumed that the decision of the farmer to use sustainable land management practices or not depends on an unobserved index determined by explanatory variables in such a way that the larger the value of the index, the greater the probability of the farmer using the practices. Independent variables were determined based on the existing literature and survey questions. As a result, age, gender, education status, marital status, land size, awareness of sustainable land management practices, land slope, distance to the extension office, and main economic activities are included in the model.

The general specification of the model is mathematically given by Dimoso (2021). The model estimates with a standard maximum likelihood method, whereas the error terms are normally distributed with a zero mean and a variance of one. Equation (1) describes the model as follows;

$$\overset{*}{Y}_i = X_i\beta_1 + u_i\,,\ \ u_t \sim \text{N}\ (0,1)\ldots\ldots(1)$$

From Equation (1),

$Y_i^*$ is a latent variable 'adoption of sustainable land management practices,

$X_i$ is a vector of observed non-random explanatory variables,

$\beta$ is a coefficient estimate of the independent variables

$\mu_i$ is an error term normally distributed with zero mean and a variance of one.

The dependent variable is unobserved. Therefore, it is sound to assume that the adoption is observed as described in Equation (2):

$$y_i = \begin{cases} 0 & If\ Y_i^* \leq 0 \\ 1 & If\ Y_i^* > 0 \end{cases} \ldots\ldots(2)$$

The model estimated the probability of adopting sustainable land management practices for observation i. The marginal effects were used to interpret the results of the model. Each marginal effect was an average of the individual marginal effects for all the responses of the particular variable. It determined the average change in the probability obtained from a one-unit change in the independent variable (Washington et al., 2011). Thus, the marginal effect indicated the average change in the response variable's probability when the indicator variable changed from zero to one (Washington et al., 2011). The marginal effect estimates of the relative effect for independent variables are presented in Equation (3).

$$\frac{\delta A_i}{\delta X_{ij}} = \beta_{ij} * f(Z_i) \quad \ldots\ldots\ldots\ldots (3)$$

Where:

$f(Z_i)$ is an inverse of the cumulative normal function

$\beta_{ij}$ are the parameter estimates.

Thus, with the assumption of Equation (2), the probit model is expressed as in Equation (4) when the variables are fitted.

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \mu_i \ldots\ldots\ldots (4)$$

Where:

$Y_i$ Binary response variable [Dummy; 0=Not adopted SLMPs, 1= adopted SLMPs]

$X_1$ Age status of the household head [Continuous; the number of years: *Expected sign (+ve)*]

$X_2$ Gender status of the household head [Dummy; 1 if the head is a male and 0 if otherwise: *Expected sign (+ve)*]

$X_3$ Education status of the household head [Dummy; 0 - nonformal education, 1 – formal education: *Expected sign (+ve)*]

$X_4$ Marital status of the household head [Categorical; 1 if married, two if not married, three if the widow(er), four if divorced: *Expected sign (-ve)*]

$X_5$ Land size [Continuous; a total number of acres: *Expected sign (+ve)*]

$X_6$ Awareness of land conservation and management [Dummy; 1 if yes, 0 if otherwise: *Expected sign (+ve)*]

$X_7$ Land slope [Categorical; 1 if flat, two if medium, three if steep: *Expected sign (+ve)*]

$X_8$ Distance to the extension office [Dummy; 0 if ≤ 5 Km, 1 if > 5 Km: *Expected sign (-ve)*]

$X_9$ Major economic activities [Dummy; 0 if peasant, 1 if agropastoralists: *Expected sign (+ve)*]

$\mu_i$ Disturbance term

## 3.0 Results and Discussion

### 3.1 Descriptive Analysis Results

The adoption of sustainable land management practices (SLMPs) in the Mbulu district, a semi-arid area in north-central Tanzania, was examined using nine (09) variables and 120 farmers. The descriptive results provide essential information about farmers' demographic, socioeconomic and land-related variables in the study area. The variables include the adoption of SLMPs, age, gender, marital status, education level, main economic activity, the slope of the land, distance to the extension office, land size, and awareness of SLMPs.

The variable, age, had 120 observations with a mean of 43.942 years and a standard deviation of 11.56 years. The minimum age observed is 17 years, and the maximum is 65 years. It suggests that the farmers studied have a wide age range, with most falling in the 30-50 age range. Land size had a mean of 3.233 and a standard deviation of 2.321. This variable measures the size of the land the farmer uses for farming, and the mean value indicates that the average farmer used a piece of land that is 3.233 acres.

The minimum land size in the studied sample is 0 acres, indicating that some farmers did not own land. However, the maximum land size is 9.5 acres, indicating that some respondents own relatively large land. Regarding gender, 80 farmers (or 80%) were male, and 24 (or 20%) were female.

Among the male farmers, 21.88% adopted land management practices, while only 8.33% of the female farmers did so. The chi-square test results show that there is no statistically significant relationship between gender and land management adoption practices ($\chi^2$ = 2.273, $p$ = 0.132). Regarding marital status, most farmers (92.5%) were married, and 18.02% adopted land management practices. In contrast, only 40% of the farmers who were not married adopted such practices. The chi-square test results show no statistically significant relationship between marital status and land management adoption practices ($\chi^2$ = 2.121, $p$ = 0.548). Regarding education level, 76.67% of farmers attended school, and 23.33% did not. Among those who attended school, 23.91% adopted land management practices, while only 3.57% of those who did not attend school did so. The chi-square test results show a statistically significant relationship between education level and land management adoption practices ($\chi^2$ = 5.733, $p$ = 0.017). Regarding economic activity, 84.17% of farmers were involved in agropastoral activities, while only 15.83% were peasants. The SLMPs adoption rate differed for the groups (21.05% for peasants and 18.81% for agropastoralists). The chi-square test results show no statistically significant relationship between major economic activities and sustainable land management adoption practices ($\chi^2$ = 0.052, $p$ = 0.820).

Concerning slope, the farmers' land was categorized as flat, medium, or steep. The adoption rate of land management practices was highest for farmers with medium slope land (35.71%), followed by those with steep slope land (21.43%) and flat slope land (11.67%). The chi-square test results show that there is a statistically significant relationship between slope and land management adoption practices ($\chi^2$ = 7.023, $p$ = 0.030). Regarding distance, 11.67% of farmers lived within 5 kilometres of the study area, while 88.33% lived farther away. The adoption rate of land management practices was higher for those who lived within 5 kilometres (35.71%) than those who lived farther away (16.98%). The chi-square test results show no statistically significant relationship between distance and land management adoption practices ($\chi^2$ = 2.801, $p$ = 0.094). Finally, for the awareness variable, 88.33% were aware of land management practices, and 72.50% of them adopted such practices. In contrast, only 27.50% of the respondents who needed to be made aware of land management practices adopted them. The chi-square test results show that there is no statistically significant relationship between awareness and land management adoption practices ($\chi^2$ = 0.123, $p$ = 0.76). Therefore, descriptive analysis suggests that education level and slope are important factors in SLMPs. At the same time, gender, marital status, economic activity, distance, and awareness do not play a significant role.

### 3.2 The Sustainable Land Management Practices adoption index results

The adoption variable was used for computing the LSMPs adoption index, a measure of the proportion of farmers who adopted the SLMPs in the study area. The study results show that only 23 farmers adopted SLMPs, whereby 91.3% were male farmers and only 8.7% were female farmers. In addition, 97 farmers did not adopt any of the SLMPs. Therefore, this gave rise to computing the adoption index given in Equation (5):

$$\text{SLMPs adoption index} = \frac{\text{SLMPs adopters}}{\text{Total number of farmers}} \times 100 = \frac{23}{120} \times 100 = \mathbf{19.2\%} \ldots\ldots\ldots\ldots\ldots\ldots(5)$$

Equation (5) shows that only a relatively small proportion of the sample, 19.2%, adopted the SLMPs. This information prompted a further investigation into the potential reasons for the adoption to determine the appropriate measures to promote greater adoption. Therefore, section 3.3 offers a detailed presentation of the reasons.

### 3.3 Results for factors influencing SLMPs adoption in the study area

The probit regression model examined the factors influencing SLMP adoption in the study area. The estimation results, on the other hand, allowed the estimation of the impact of factors on the probability of adoption while controlling for other relevant factors. However, the descriptive analysis results do not provide information on the factors that drive the adoption behaviour or the extent to which the variables are statistically significant predictors of SLMP adoption. In addressing this gap, probit regression analysis was performed to estimate the probability of adopting SLMPs based on a set of explanatory variables identified in Equation (4), as shown in Table (1).

**Table 1: Probit estimation results**

| Variables | Coef. | St. Err. | t-value | p-value | [95% Conf | Interval] | dy/dx | Sig |
|---|---|---|---|---|---|---|---|---|
| **Gender (BG: Female)** | | | | | | | | |
| Male | 0.935 | 0.557 | 1.680 | 0.093 | -0.157 | 2.026 | 0.156 | * |
| **Age** | -0.001 | 0.014 | -0.090 | 0.926 | -0.029 | 0.026 | | |
| **Marital status (BG: Married)** | | | | | | | | |
| Not married | 0.706 | 0.772 | 0.910 | 0.361 | -0.808 | 2.220 | | |
| Widow(er) | 1.932 | 1.113 | 1.740 | 0.083 | -0.249 | 4.113 | 0.526 | * |
| **Education (BG: Not attended)** | | | | | | | | |
| Attended formally | 0.952 | 0.530 | 1.790 | 0.073 | -0.088 | 1.991 | 0.163 | * |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Econ activity (BG: Peasant)** | | | | | | | | |
| Agropastoral | 0.035 | 0.432 | 0.080 | 0.935 | -0.810 | 0.881 | | |
| **Land_Size** | 0.142 | 0.072 | 1.970 | 0.049 | 0.001 | 0.282 | 0.030 | ** |
| **Slope (BG: Flat)** | | | | | | | | |
| Medium | -0.430 | 0.504 | -0.850 | 0.393 | -1.417 | 0.557 | | |
| Steep | 0.366 | 0.554 | 0.660 | 0.509 | -0.721 | 1.453 | | |
| **Distance (BG: $\leq 5km$)** | | | | | | | | |
| $\geq 5km$ | -0.922 | 0.424 | -2.170 | 0.030 | -1.753 | -0.09 | -0.235 | ** |
| **Awareness (BG: No)** | | | | | | | | |
| Yes | -0.241 | 0.379 | -0.630 | 0.526 | -0.984 | 0.503 | | |
| Constant | -1.956 | 1.179 | -1.660 | 0.097 | -4.268 | 0.355 | | * |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.193 | SD dependent var | 0.397 |
| Pseudo r-squared | 0.224 | Number of obs | 120 |
| Chi-square | 26.167 | Prob > chi2 | 0.006 |
| Akaike crit. (AIC) | 114.677 | Bayesian crit. (BIC) | 148.026 |

**** p<.01, ** p<.05, * p<.1*

The probit model specified in fitted in Equation (4) was used to analyze the factors of SLMP adoption decisions. The dependent variable in this model is the dichotomous variable: to adopt or not adopt the SLMPs. The independent variables were determined based on the existing literature and survey questions. As a result, gender, age, marital status, education level, major economic activities, land size, the slope of the land, distance to extension offices, and awareness of sustainable land management and conservation are included in the model. The analysis was conducted using the STATA software package. Table (1) presents details of parameter estimates.

Table (1) shows that the probit model explains the SLMP adoption decision well. Pseudo $R^2$ of 0.224 indicates a good model fit, as supported by the recommendation of McFadden (1979) that a range between 0.2 and 0.4 means a good fit for the model. Also, the Chi-square value (P<0.006) is highly significant. Thus, these suggest that the model is good-fit and has a strong explanatory power. The analysis results revealed that several variables influenced the adoption of SLMPs. The variables significantly influencing the SLMP adoption include gender, marital status, education, land size, and distance to the extension offices.

As expected, the coefficient of being a male is positive (0.935) and significant at p<.1, demonstrating that gender is an important factor that affects whether or not to adopt the SLMPs. Importantly, it implies that male-headed households favourably adopt SLMPs more than female-headed households. Furthermore, it means that being male, ceteris paribus, increased the chance of adopting the SLMPs by 15.6%, which is consistent with the finding of Adetomiwa et al. (2022) and Oduniyi (2022). On the contrary, females are technically absorbed by domestic chores. Consequently, female-headed households needed more time to adopt the SLMPs even if they wished to.

Interestingly, the coefficient of marital status (widow[er]) is positive (1.932) and significant at p<.1, revealing that marital status was an essential factor determining the adoption of SLMPs in the study area. Further, the marginal effect value depicts that being a widow(er), ceteris paribus, increases the likelihood of SLMP adoption for a particular farmer by 52.6%. It means that the widow(er) is carefully taking all the necessary steps to ensure the family gains sustainability after losing the spouse and knowing the dangers that may result when the SLMPs are not well used to their premises. So, the adoption of the SLMPs prompts future prosperity within the family. The findings are backed up by Adetomiwa et al. (2022) and Oduniyi et al. (2022), which reported marital status as an important variable when adopting land management practices in their study areas.

Also, the coefficient of education is positive (0.952), as expected and significant at p<.1, implying that formal education influences the adoption of SLMPs in the study area. The marginal effect value shows that a one-unit increase in formal education, ceteris paribus, would result in a 16.3% increase in the probability of adopting the SLMPs. The results mean that education may enhance competence in learning new ideas, influencing farmers to adopt the SLMPs. Moreover, more access to formal education can enhance knowledge and promote investment in sustainable land management practices in the study area. This result is concurrent with the findings from Belay et al. (2015), Kayode et al. (2017), Haftu et al. (2019), and Belachew et al. (2020).

Aside from that, the coefficient for land size is positive (0.142), as expected, and significant at p<.05, indicating that land size influenced the SLMP adoption positively. The marginal effect value suggests that a one-acre increase in land size, ceteris paribus, increased the probability of a farmer adopting the SLMPs in the study area by 3%. The results suggest that a farmer in the study area will likely adopt SLMPs if they own or cultivate a relatively large plot of land. Also, with more extensive land, the farmer could apply the SLMPs and afford the risks that may arise, such as a smaller plot of land after implementing the SLMPs, which can affect the harvest over the short run. The results are consistent with those of Kayode et al. (2017), Kirui (2017), Haftu et al. (2019), and Belachew et al. (2020).

Furthermore, the distance coefficient to extension offices is negative (-0.922) as expected and significant at p<.05, indicating that an increase in distance to the extension offices reduced the possibility of a farmer adopting the SLMPs in the study area. The marginal effect suggests that being farther than 5km from the extension offices, ceteris paribus, decreases the probability of SLMP adoption by 23.5%. Further, it means that an increase in distance diminished the capability of the farmer-extension officer's contacts, thereby limiting the chance of acquiring expert advice on SLMPs. As a result, it constrained the likelihood of a particular farmer adopting the SLMPs. On the other hand, the shortest distance to the extension office guaranteed farmers easy access to up-to-date information from the extension officers, who could ultimately influence the adoption. The findings concur with the results of Haftu et al. (2019), that reported distance to agricultural extension services as an important indicator of sustained use of sustainable land management activities.

In summary, gender, marital status, education, land size and distance to the extension offices were the main factors determining whether or not to adopt the SLMPs for the farmers in the study area. Therefore, these variables affect the adoption decisions in the study area significantly. By linking the descriptive results to the probit results, the study gained a deeper understanding of the factors that influenced the adoption behavior so as to identify the most effective interventions for promoting the sustainable land management practices.

## 4.0 Conclusion and Recommendations

This study examined the factors influencing the adoption of sustainable land management practices (SLMPs) on agricultural activities in the Mbulu district, a semiarid area in North-Central Tanzania. A cross-sectional quantitative study was performed, and data from 120 farmers were collected using semi-structured questionnaires. SPSS version 20 and STATA version 13 were used for data analysis. Descriptive statistics provided essential information about farmers' demographic, socioeconomic and land-related variables in the study area. The variables included the adoption of SLMPs, age, gender, marital status, education level, main economic activity, the slope of the land, distance to the extension office, land size, and awareness of SLMPs.

On the other hand, the adoption index was computed to establish the extent of SLMP adoption. A probit regression model was used to examine the factors influencing the adoption. The findings suggest that being male, having a formal education, being widowed, having an extensive land size, and being closer to the extension offices, which ease access to information about sustainable land management practices, increase the likelihood of adopting sustainable land management practices. Meanwhile, age, marital status (except for being widowed), economic activity, the slope of the land, and awareness of land management have no significant effect.

Based on these findings, the study recommends that outreach and education efforts should also emphasize targeting female-headed farmers, those with lower levels of education, and those farther than 5 km away from the extension offices to increase adoption rates for SLMPs. Moreover, awareness-raising programmes must be more targeted and effective to reach the intended audience. Additionally, further research should be conducted to explore why being widowed positively affects adoption rates, as this may provide insights for designing more effective interventions. Furthermore, gender-sensitive strategies and policies should be developed to encourage women's participation in the SLMPs, and demonstration plots for sustainable land management practices should be established closer to farmers' premises to boost access to learning by doing. In addition, policymakers should prioritize interventions to promote the level of SLMP adoption among the farmers in the study area.

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