



Does Information Acquisition Influence the Adoption of Sustainable Land Management Practices? Evidence From Mpumalanga Province South Africa

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Agricultural information plays a vital role in adopting agricultural technology. The study explored if information acquisition is related to the adoption of sustainable land management practices (SLMP) and jointly decided in Mpumalanga Province of South Africa. Primary data were collected through face-to-face interviews, using a proportionate random sampling technique to get 250 smallholder farmers to participate in the survey. A seemingly unrelated bivariate probit (SUBP) model and a recursive bivariate probit (RBP) model were adopted to examine the objective. The statistical estimation of the SUBP showed that there is a relationship, an empirical association between information acquisition and SLMP; while RBP estimation showed that information acquisition was exogenous in the adoption model; thus, the decision to acquire information and adopt SLMP was not jointly decided. Therefore, the study presents the determinants of information acquisition alongside with the adoption of SLPM. The result from the SUBP model, indicated that the years spent in school; agricultural extension service; the number of extension visits and the years of farming, influenced both information acquisition and the adoption of SLMP. The cost attached positively influenced the adoption of SLMP; while gender, marital status and age only influenced the information acquisition.

Keywords: information acquisition, adoption of SLMP, SUBP, RBP, South Africa

BACKGROUND

Smallholder farming continues to play a significant role in South African agriculture (Pienaar and Traub, 2015). However, climate change, poor infrastructure, soil degradation and tough economic conditions amongst others are the major constraints facing small-scale agricultural productivity in sub-Saharan Africa (Kom et al., 2020). Land degradation and climate change are the double threat which has a huge impact on human security, food security, loss of biodiversity and ecosystem services, land availability for agricultural production (Behrend, 2016; Davies, 2016). In South Africa, land degradation and especially soil erosion is currently a major concern both in commercial farming and smallholders farming sector (Critchley and Netshikovhela, 1998; Oduniyi, 2018). The degradation of agricultural soils negatively impacts soil health and productive capacity.

Consequently, Food and agriculture organization (FAO, 2009) reported that about a third of the world's soil has already been degraded as a result of land degradation, intensive farming, climate change, chemical-heavy farming techniques and deforestation which increases erosion. The author further explained that it takes 1,000 years to generate three centimeters of topsoil. However, should the present rate of degradation persist, it is obvious that virtually the entire world's topsoil could disappear within the space of 60 years (FAO, 2009). Given the findings, it is thus pertinent that an urgent approach and concept be adopted to stem or reverse the calculated disappearance of the topsoil. However, sustainable land management practices (SLMP) could be the way forward to curb this *environmental pandemic* which has become a social issue globally. SLMP are needed to reverse and renew degraded lands, mitigate and adapt to the changing climate.

Sustainable land management practices (SLMP) are schema that deals with the fundamental constituents of the global life support system. As defined by the TerrAfrica partnership (TerrAfrica, 2006), "SLMP is the adoption of land-use systems that, through appropriate management practices, enables land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources". The exploitative occurrence of the negative effects of natural resources experienced by food producers is so ubiquitous that it has given rise to a universal and growing awareness that productive lands are scarce, thus; divulging the knowledge that the land under cultivation needs greater intensive care. Moreover, it cannot be gainsaid that sustainable land management is the sub-structure for grounding sustainable agriculture in addition to functioning as an integral strategic element that enables a perennial sustainable development, besides serving as a tool of poverty alleviation

Additionally, SLMP focus on alleviating the detrimental impact of climate change on productivity, concurrently preventing the degradation of natural resources with issues relating to ecological, economic and socio-cultural dimension (Olsson et al., 2019). Intrinsically, the primary aim of SLMP is to incorporate people's coexistence with nature in the long term so that provisioning, regulating, cultural and supporting services of ecosystems are ensured (The Intergovernmental Panel on Climate Change, IPCC, 2013). It is a key measure in adapting to the effects of climate change. The essence of adopting SLMP is to develop a synergism between environmental issues and food security. In South Africa, the World Overview of Conservation Approaches and Technologies (WOCAT) has instigated for years with numerous approaches and technologies been documented on SLMP. However, several practical problems arise in espousing and fully adopting SLMP owing largely to information gaps on SLMP as well as indifference among farmers toward transitioning from traditional to modern farming practices (Olawuyi and Mushunje, 2020).

Agricultural information plays a vital role in adopting agricultural technology (Rivera, 2000; Bonabana-Wabbi, 2002; Jabbar et al., 2003). Agricultural information is a long-term stimulus for agricultural development and also an important indicator of agricultural modernization (Zhang

et al., 2016). Perhaps information acquisition is a prerequisite for the introduction of new agricultural technology such as SLMP. According to Mwangi and Kariuki (2015), access to information creates awareness and influences farmers' decisions to adopt new agricultural technology. However, having access to information does not guarantee adoption of SLMP due to heterogeneity composition which makes farmers perceive and assess information differently leading to adoption and dis-adoption of new technology such as SLMP (Uaiene et al., 2009). In the same vein, this information is acquired through agricultural extension officers, farmers' groups, etc. (Vidanapathirana, 2019). Information acquisition in the study area is shared within the social group such as the farmers' group.

However, the bone of contention in this regard is to know whether information acquisition and the adoption of SLMP are related and jointly decided. Although there has been some literature on SLMP such as the impact of adoption of SLMP on welfare, adoption and determinants of SLMP, but nothing has ever been written on the effect of information on SLMP adoption in South Africa. Thus, this study serves as a blueprint and sets the pace for future research work. The outcome will help the farmers, government, policy-makers and the stakeholders concerned to understand the linkage between information acquisition and the adoption of SLMP; and if the decision to acquire information and adoption of SLMP is jointly determined and decided. Overall, this will provide insight into the factors that influence the information acquisition and adoption of SLMP in the study area. It is, therefore, worthwhile to conduct this research.

Research question: Does information acquisition and the adoption of SLMP related (simultaneously determined) and jointly decided.

Hypothesis: The hypothesis for this study is stated in the null form: Adoption of sustainable land management and information acquisition are not related (not simultaneously determined); there is no significant relationship between the two and are not jointly decided.

MATERIALS AND METHODS

The Study Area

The study was conducted in the Gert Sibande District Municipality in Mpumalanga, South Africa as shown in **Figure 1**. The district covers an area of 31,841 km², which makes it the largest district in the province. The district is divided into seven local municipalities, namely: Govan Mbeki, Chief Albert Luthuli, Msukaligwa, Dipaleseng, Mkhondo, Lekwa, and Dr. Pixley ka Isaka Seme. To the north, it is bordered by the Ehlanzeni and Nkangala District Municipalities, to the south by KwaZulu-Natal and the Free State, to the east by Swaziland and to the west by Gauteng. The major economic sectors are mining, agriculture, energy and manufacturing. The municipality is chosen because of its high concentration of subsistence farmers, and similarly, SLMP has been mapped out and adopted into this province long before now.

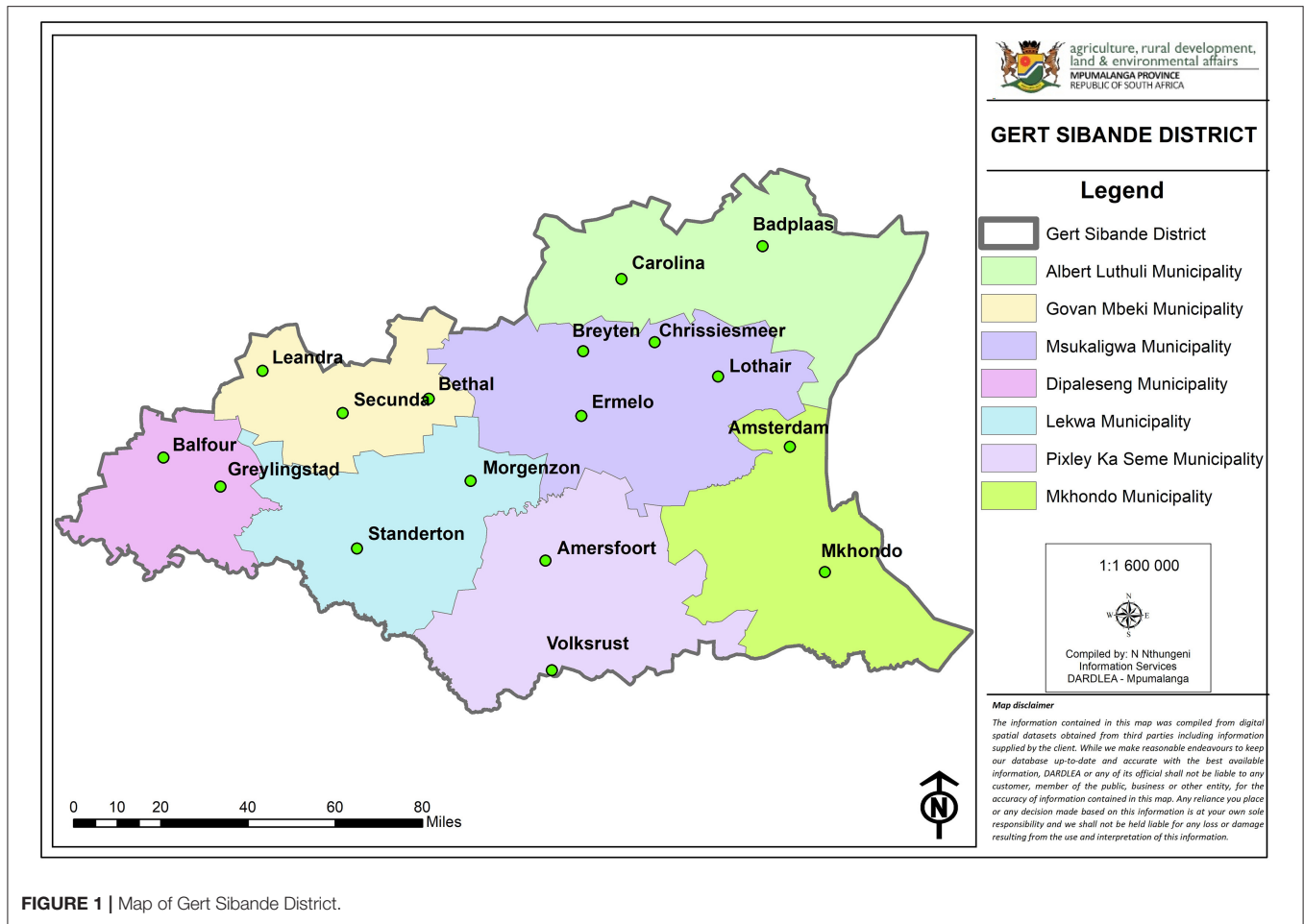


FIGURE 1 | Map of Gert Sibande District.

Sampling Technique and Data Collection

Cross-sectional data were used for this study. Data was collected between December 2019 and August 2020, using a semi-structured survey questionnaire validated by two agricultural economist experts (independent experts). A reliability test was performed on the questionnaire to ascertain its use. The questionnaire contained logic flow questions aimed at farmers’ demography, information acquisition of SLMP, social groups and the adoption of SLMP. The survey was conducted through face-to-face interviews; each session with the farmers lasted 40 min. A representative sample size was determined, using Slovin’s formula given in Equation (1) after which a total number of 250 questionnaires were administered to the maize farmers in the district by four trained enumerators who translated the questionnaire into local language for farmers to understand. A proportionate random sampling technique was used to select the sample size where each local municipality represent a stratum from which sample were randomly obtained. This was achieved by adopting a quantitative model, as presented below:

$$n = \frac{N}{1 + N(e)^2} \tag{1}$$

Where n is the sample size,

TABLE 1 | Sample size taken in each municipality (stratum).

Municipalities	Frequency	Percent
Govan Mbeki	42	16.8
Albert Luthuli	33	13.2
Mkhondo	60	24.0
Msukaligwa	34	13.6
Lekwa	32	12.8
Pixley Ka Seme	19	7.6
Dipaleseng	30	12.0
Total	250	100.0

Source: Author’s computation (2021).

- N = total population of maize farmers in the seven local municipalities across the district
- e = maximum variability or margin of error (MoE). This is estimated at 5% (0.05)
- 1 = probability of the event occurring
- 250 = the number of respondents sampled or sample size.

Table 1 shows the distribution of sample size collected according to each municipality or stratum.

Data Analytical Techniques

Data were analyzed, using both descriptive and inferential statistics. Descriptive statistics such as mean values, standard deviation and percentages were used to describe the farmers' socioeconomics, information acquisition and adoption of SLMP. Subsequently, a seemingly unrelated bivariate regression (SUBP) and recursive bivariate probit (RBP) model were used as inferential statistics to investigate if the decisions to acquire information on SLMP are jointly determined and simultaneously lead to the smallholder maize farmers adopting SLMP.

Conceptual Framework

In reality, the decision of a farmer to adopt sustainable land management practices preceded by information received or acquired on SLMP. This information is mostly shared and acquired by the social capital group. Thus, every member of a social group (mostly farmer groups) decides whether or not to make use of the information. Thus, there occur unobserved characteristics leading into endogeneity problem, in which failure to take account of it will lead into biased and spurious result (Owusu et al., 2020; Oduniyi and Chagwiza, 2021). However, if the net benefit associated with the adoption is positive or greater than otherwise, then the farmer decides to adopt the innovation. In this instance two procedures occur that are dichotomous and mutually decided or simultaneous to each other. This requires joint estimation of the two sets of procedures or equations relating to decision models which do not necessarily involve the same independent variables or regressors but contain the same error terms just like in the instance of seemingly unrelated regression equations (SURE) model. However, the dependent variables involved are the binary options; information acquisition on SLMP can be represented as ($y_1 = 1$) or otherwise ($y_1 = 0$). Correspondingly, for adopting or non-adopting SLMP can be represented by ($y_2 = 1$) or ($y_2 = 0$), respectively.

Model Specification

Seemingly Unrelated Bivariate Regression

In other words, a seemingly unrelated bivariate regression (SUBP) was employed to determine if information acquisition relate to the adoption of SLMP; or if the information acquisition on SLMP simultaneously determined alongside with the adoption of SLMP. Following Thuo et al. (2014), Tuna et al. (2017), and Olawuyi and Mushunje (2020), SUBP was used to determine a joint relation of two binary equation models. This model is often used to investigate if two dependent variables mentioned are correlated with unobserved characteristics among farmers. To some extent the model is similar or comparable to bivariate probit; and it generalizes the index function model from one latent variable to two latent variables that may be correlated (Seyoum, 2017). This can be mathematically written as follows:

$$y^*_1 = \beta X' + \varepsilon_1 \tag{2}$$

$$y^*_2 = \delta Z' + \varepsilon_2 \tag{3}$$

where: $y_1 = 1$, if $y^*_1 > 0$, otherwise $y_1 = 0$

$y_2 = 1$, if $y^*_2 > 0$, otherwise $y_2 = 0$

y^*_1 and y^*_2 are unobserved latent variables that represent the tendency for awareness

and the decision to adopt SLMP, respectively

The variables y_1 and y_2 denote the observable responses (0 or 1)

X and Z are vectors of covariates

b and d are vectors of unknown parameters to be estimated

ε_1 and ε_2 are joint normal with means zero, variances one and correlation ρ .

As pointed out by Cameron and Trivedi (2009), the coefficient ρ , captures the possible effect of unobserved characteristics on the two equations which could be positive, negative, or null. The error terms are assumed to be zero-mean bivariate normally distributed with unit variance and correlation coefficient (Tuna et al., 2017). The correlation between the errors in the two equations, can be interpreted as the interdependence of the unobserved components in the information acquisition and adoption of SLMP.

Recursive Bivariate Probit (RBP) Model

As mentioned earlier, due to the possible endogeneity, a recursive bivariate probit (RBP) modeling technique was employed to deal with the observed and unobserved selection bias. This technique has also been applied in previous studies (Vall Castello, 2012; Ma et al., 2018). For example, Ma et al. (2018) adopted the RBP model to investigate the impact of cooperative membership on the adoption of organic soil amendments and chemical fertilizer in China. Similarly, in this study, the recursive bivariate probit (RBP) model was employed to establish if the information acquisition of SLMP is endogenous in the adoption of the SLMP model. That is if information acquisition, as an explanatory variable used in the adoption of the SLMP model, is jointly decided with the unobservable factors captured by the error term (Thuo et al., 2014). Thus, the presence of endogeneity advocates that both choices made from the two equations are jointly decided. The model can be represented, as shown below:

$$y^*_1 = \beta X' + \varepsilon_1 \tag{4}$$

$$y^*_2 = \alpha y^*_1 + \delta Z' + \varepsilon_2 \tag{5}$$

It should be noted here that the parameters expressed are the same as in the SUBP above; however, αy^*_1 denote the inclusion of dependent variable (awareness of SLMP) in the first and second equation.

Table 2 shows the variables used in the model and their measurement.

RESULTS AND DISCUSSION

Descriptive Analysis Results

With Table 3 presents descriptive statistics of the sample of the explanatory variables used. The average age of the smallholder maize farmers in the study area was found to be 48 years, with an average of 10 years spent in school. The mean visit by an extension officer was found to be at least twice a month. The majority of farmers had an average of 11 years of farming experience and the mean farm size was found to be 123

TABLE 2 | Variables used in the model and their measurements.

Variables	Description and variable measurement	Expected sign
Adoption of SLMP	Dummy, 1 if yes, 0 if otherwise	
Information acquisition	Dummy, 1 if yes, 0 if otherwise	
Explanatory variables		
Gender	Dummy, 1 if household head is a male and 0 if otherwise	+
Age	Number of years (Continuous)	-
Years spent in school	Number of years (Continuous)	+
Farm size	Size in hectares (Continuous)	+/-
Years of farming	Number of years (Continuous)	+/-
Access to ext ser	Dummy, 1 if yes, 0 if otherwise	+
The cost attached (R)	Cost in ZAR (Continuous)	+
Marital status	Dummy, 1 if household head is married, 0 otherwise	-
Member in soc org	Dummy, 1 if yes, 0 if otherwise	+
Access to credit	Dummy, 1 if yes, 0 if otherwise	+
Freq. of extension visit	Categorical (1 = Not at all, 2 = Seldom, 3 = Frequently)	+

Source: Author's computation (2021).
+, positive; -, negative.

TABLE 3 | Summary statistics of the variables used.

Variable	Mean	Std. deviation
Gender	0.524	0.500
Age	48.472	12.285
Marital status	0.472	0.500
Years spent in school	10.268	4.842
Extension service	0.816	0.388
Number of extension visits	2.288	0.779
Member of organization	0.684	0.466
Years of farming	10.828	6.774
Farm size	123.016	242.980
Cost attached	0.796	0.404
Access to Credit	0.472	0.500
Percentages (%)		
Adoption of SLMP	Adopters (93.2%)	Non-adopters (6.8%)
Information acquisition	Acquired (70.8%)	Non-acquired (29.2%)

Source: Data analysis (2021).

hectares. Similarly, about 93% adopted at least one practice of sustainable land management while 71% claimed that they acquired information on SLMP.

Empirical Results

The study examined the linkage of how information acquired by farmers on SLMP relates to adoption. The two models used explore variables considered to be exogenous to the two dependent variables. The exception is information acquisition in the RBP models, a matter that is subjected to econometric

testing. From the SUBP result, the first procedure was to use Wald test (LR test) to evaluate the null hypothesis that rho is zero (0). The value of rho (5.90e-10) was significant at the 1% level (Chi-square = 35.1773, df = 1, p-value = 0.0000). The result indicated the probability that a farmer acquired information was indeed related to the probability of adopting SLMP through unobserved effects captured in the error terms of the models. The positive sign for rho in the SUBP model indicates that the two variables are complementary to each other. A way to think about these results is that information acquisition and the adoption of SLMP worked together as a strategy for improved productivity. Thus, there is a relationship between the information acquisition and adoption of SLMP. This finding is consistent with the submission of Huth and Allee (2002) and Moreno and Sunding (2003) who acknowledged that positive value for rho suggests a complementary decision variable.

In the RBP model, as shown in **Table 4**, the non-statistically significant (0.1160) results of the Wald test (LR test) for rho = 0 indicated that information acquisition is exogenous which suggested that the decision to acquire information and adopt of SLMP was not jointly decided. This is not surprising as some farmers who adopted SLMP did not acquire information, vice versa. The reason is not farfetched from the fact that most smallholder farmers practice sustainable agriculture unaware. They still practice primitive form of agriculture such as bush fallow, mulching, planting cover crops, crop rotation etc.; which are typical examples of SLMP, thus, they adopted SLMP unknowingly without acquiring information on SLMP. Hence, information acquisition and adoption of SLMP was not jointly decided.

SUBP Model Result for Information Acquisition

The results from the SUBP model revealed that the number of years spent in school (education); access to agricultural extension service; number of agricultural extension visits and the number of years of farming jointly influenced information acquisition and adoption of SLMP. *The years of farming or farming experience* of a farmer was found statistically significant. The result shows that the lower the years of experience, the lower or less likely a farmer acquire information and/or adoption of SLMP, vice versa. This was in support to a report by Alam (2015) who reported that farmers with more experience in agriculture are more likely to adopt agricultural innovation.

The number of years spent in school signifies the education of the head of the household. The result in **Table 5** shows that education was found to be statistically significant and it positively influenced information acquisition and adoption of SLMP. This advocates that an educated or literate household head farmer has a propensity to acquire more information and adopt SLMP. This is confirmed by the findings of LaFerrara (2002) and Haddad and Maluccio (2003) who reported that higher education encourages farmers to seek and acquire more information. This was contrary to Thuo et al. (2014) who affirmed that farmers with more years of education are less likely to adopt new agricultural practices.

TABLE 4 | Recursive bivariate probit.

Variables	Information acquisition		Adoption		dy/dx
	Coeff	Z	Coeff	Z	
Information acquisition	-	-	2.107	1.18	0.030
Gender	0.445	2.10**	-0.307	-0.88	0.099
Marital status	-0.533	-2.43**	-	-	-0.123
Age	0.031	2.93***	0.025	0.98	0.008
Years spent in school	0.108	4.41***	0.192	2.14**	0.028
Extension service	-1.032	-2.51***	-2.620	-2.74***	-0.276
Number of extension visits	1.089	5.18***	1.441	2.99***	0.273
Member of organization	-0.336	-1.31	0.931	1.84**	-0.065
Years of farming	-0.037	-2.35**	-0.042	-1.79**	-0.009
Farm size	0.000	0.15	-0.002	-1.51	-8.58e-06
Cost attached	-	-	1.955	2.50***	0.028
Access to Credit	-	-	-3.093	-1.31	-0.010
Constant	-3.093	-2.02	-1.924	-2.02	
/athrho	13.821	0.02			
Rho	1	3.11e-09			

LR test of rho = 0: $\chi^2(1) = 2.47027$; Prob > $\chi^2 = 0.1160$.
 Wald $\chi^2(19) = 102.70$.
 Log likelihood = -125.81726.
 Number of obs = 250.
 *p < 0.01; **p < 0.05; ***p < 0.1 level, respectively.
 Source: Data analysis (2021).

Access to agricultural extension services was found to be statistically significant and it negatively affected information acquisition and adoption of SLMP. The result suggests that farmers with access to agricultural services are less likely to acquire information and adopt SLMP. The possible reason could be that, despite having access to the agricultural extension service, little or few information related to SLMP were shared. However, the farmers claimed to have acquired more related information on SLMP from a social capital group, such as farmer's group and cooperative group. This result goes against the study carried out by Katungi et al. (2008) in Uganda who reported that extension activity in the village is an important determinant of information exchange related to agricultural technologies among rural people.

The number of agricultural extension visits were statistically significant and positively influenced the information acquisition and adoption of SLMP. The result suggests that the more visits a farmer received the more likely he/she acquired more information about SLMP. Most farmers explained that more visits provide an avenue to ask questions on the information which they have acquired from the social capital group on SLMP, which becomes easy to adopt. Normally, a farmer with higher extension activity is more likely to engage in a two-way information exchange compared to those with less frequent extension activity. This result is buttressed by Ntshangase et al. (2018) and Oduniyi (2018), who affirmed that access to extension

TABLE 5 | Seemingly unrelated bivariate probit.

Variables	Information acquisition		Adoption		dy/dx
	Coeff	Z	Coeff	Z	
Gender	0.458	2.09**	-0.248	-0.71	0.100
Marital status	-0.526	-2.40**	-	-	-0.120
Age	0.032	2.97***	0.016	0.80	0.008
Years spent in school	0.109	4.45***	0.127	2.10**	0.027
Extension service	-1.030	-2.49***	-1.850	-3.45***	-0.265
Number of extension visits	1.085	5.14***	1.450	3.18***	0.271
Member of organization	-0.342	-1.31	0.821	1.56	-0.064
Years of farming	-0.037	-2.30**	-0.047	-1.80**	-0.009
Farm size	0.000	0.05	-0.000	-1.02	-6.80e-06
Cost attached	-	-	1.159	2.89***	0.019
Access to Credit	-	-	-0.799	-1.32	-0.013
Constant	-2.864	-4.99	-1.924	-1.94	
/athrho	14.390	0.03			
Rho	1	5.90e-10***			

LR test of rho = 0: $\chi^2(1) = 35.1773$; Prob > $\chi^2 = 0.0000$.
 Wald $\chi^2(19) = 104.31$.
 Log likelihood = -127.05119.
 Number of obs = 250.
 *p < 0.01; **p < 0.05; ***p < 0.1 level, respectively.
 Source: Data analysis (2021).

service is not enough; the intensity of the extension services is critical in determining the level of adoption.

Other factors that influence information acquisition and adoption of SLMP independently are:

The gender of the farmers was found to be positive and statistically significant ($p < 0.05$) in influencing information acquisition. The result explained that male farmers are more likely to acquire information on SLMP. The reason for this could be that male farmers dominate the farming industry and they have better access to agricultural resources such as land, agricultural inputs, including information acquisition. Female heads of households compared to their male counterparts are likely to be disadvantaged in their access to a social capital group that facilitates information flow. This result is confirmed by Katungi et al. (2008) who reported that female heads of households are expected to acquire less information on agricultural technologies and new practices compared to their male counterparts.

The age of the household heads was found to be significant ($p < 0.01$), and it contributes to information acquisition. This suggests that the older the household head, the better the chances of acquiring information on SLMP. This is not surprising as most old farmers are used to soil management practices and cultivation practices, such as mulching and crop rotation, which are an example of SLMP. Thus, it is easier for them to relate and acquire information on SLMP. This is interesting as it negates many findings that reported that old age discourages an individual from acquiring information

(Alesina and La Ferrara, 2002; Godquin and Quisumbing, 2006). It should be noted here, that age and farming experience are synonymous. Thus, this conform to the earlier explanation that a farmer with few farming experiences is less likely to acquire information, while a farmer with more years of experience is more likely to acquire information.

The *Marital status* of the household head was statistically significant ($p < 0.05$) and negatively influenced information acquisition. This explains that a married household head farmer is less likely to acquire information on SLMP. Of course, a married household head will discuss information with his/her partner before acquiring information; however, in most cases, the influence of the other partner rejects the acquisition.

The *cost attached* to the adoption of SLMP was statistically significant ($p < 0.01$) and found to be positive; thus, influencing the adoption of SLMP. The study suggests that cost involvement increases the probability of SLMP adoption in the study area. The result is surprising as smallholder farmers are not rich and they are always skeptical to cost attached to farm innovation. It is always believed that smallholder farmers' willingness to pay for technology is far low. Although, some farmers claimed that if costs are involved with the opportunity of improving crop yield, then they would not mind paying for it. This result is conformed to Alemu et al. (2021) who reported that smallholder farmers' willingness to pay for SLMP in the Upper Blue Nile basin in Ethiopia was found to be 76%.

Similarly, a study conducted by Takele and Umer (2020) in Homosha, Ethiopia found revealed that the total willingness to pay for SLMP among small-scale farmers was found positive and significant. The study concluded that household's willingness to pay more than 66 percent cost for any SLMP to improve agricultural production by examining their total willingness to pay for SLM. It is expected that if net benefits exceed the cost of adoption, then the farmer decides to adopt the SLMP. However, farmers have always looked at new technologies as a way to reduce costs. All the same, this result was supported by The Organisation for Economic Co-operation Development (OECD) (2001) which explained that to survive, farm production must be cost/price-driven. New technology is therefore needed to increase productivity. Farmers must keep up with improvements in technology to stay in business.

CONCLUSION AND RECOMMENDATION

The study examined if information acquisition and adoption of SLMP is related and jointly decided in which both SUBP and RBP were explored. The result from the RBP model revealed that the $\text{Prob} > \chi^2$ was not statistically significant, the result of the Wald

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test (LR test) of $\rho = 0$ shows that information acquisition is exogenous, there is no problem of endogeneity, suggesting that the decision to acquire information and adopt SLMP was not jointly decided.

Similarly, the result from the SUBP estimate explains that ρ was statistically significant and positive, the $\chi^2 = 35.1773$, $df = 1$, $\text{Prob} > \chi^2 = 0.000$, which suggested that information acquisition and adoption of SLMP are correlated and complementary to each other. The years spent in school; agricultural extension service; number of extension visits; and years of farming influenced both information acquisition and adoption of SLMP. The cost attached to SLMP positively influenced the adoption of SLMP, while gender, marital status and age only influenced information acquisition.

The study therefore recommends that to promote eco-friendly and sustainable agriculture through SLMP, effective training on SLMP and capacity building be established among the agricultural extension officers and that the number of visitations to farmers be increased. Workshops and training on SLMP should be provided to the farmers, to increase awareness, information and adoption of SLMP. Farmers' social group needs to be fortified. The NGO and stakeholders concerned must help with some resources needed by the farmers to improve the adoption of various SLMP at a time.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of South Africa. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ST is the fundholder and while OO works on the manuscript. All authors contributed to the article and approved the submitted version.

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