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Research article

Listen to the radio and go on field trips: A study on farmers' attributes to opt for extension methods in Northwest Ethiopia

Yemane Asmelash Gebremariam[1,2,*], Joost Dessein[2], Beneberu Assefa Wondimagegnhu[3], Mark Breusers[4], Lutgart Lenaerts[2], Enyew Adgo[5], Steven Van Passel[6], Amare Sewnet Minale[7] and Amaury Frankl[8]

[1] Department of Rural Development and Agricultural Extension, Bahir Dar University, Ethiopia
[2] Department of Agricultural Economics, Ghent University, Belgium
[3] Policy Studies Institute Ethiopia, Economic sectors policy studies, Ethiopia
[4] Institute for Anthropological Research in Africa, KU Leuven, Belgium
[5] Department of Natural Resource Management, Bahir Dar University, Ethiopia
[6] Department of Engineering Management, University of Antwerp, Belgium
[7] Department of Geography and Environmental Studies, Bahir Dar University, Ethiopia
[8] Department of Geography, Ghent University, Ghent, Belgium

* **Correspondence:** Email: YemaneAsmelash.Gebremariam@UGent.be; Tel: +32465947419.

Abstract: Extension professionals are expected to help disseminate agricultural technologies, information, knowledge and skills to farmers. In order to develop valuable and long-lasting extension services, it is essential to understand the methods of extension that farmers find most beneficial. This understanding helps adopt improved practices, overcome barriers, provide targeted interventions and continuously improve agricultural extension programs. Thus, assessing factors affecting farmers' choice of agricultural extension methods is essential for developing extension methods that comply with farmers' needs and socio-economic conditions. Therefore, we analyzed the factors affecting farmers' preferences in extension methods, using cross-sectional data collected from 300 households in two sample districts and 16 Kebelles in Ethiopia between September 2019 and March 2020. Four extension methods, including training, demonstration, office visits and phone calls were considered as outcome variables. We fitted a multivariate probit model to estimate the factors that influence farmers' choice of extension methods. The results of the study showed that the number of dependents in the household head, formal education and membership of Idir (an informal insurance program a community or group runs to meet emergencies) were negatively associated with farmers' choices to

participate in different extension methods compared to no extension. On the other hand, the sex of the household head, farm experience, participation in non-farm activities, monetary loan access, owning a mobile phone, radio access and membership of cooperatives were found to have a statistically significant positive impact on farmers' choices of extension methods. Based on these findings, the government and the concerned stakeholders should take farmers' socio-economic and institutional traits into account when selecting and commissioning agricultural extension methods. This could help to develop contextually relevant extension strategies that are more likely to be chosen and appreciated by farmers. Furthermore, such strategies can aid policymakers in designing extension programs that cater to farmers' needs and concerns. In conclusion, farmers' socio-economic and institutional affiliation should be taken into consideration when selecting agricultural extension methods.

Keywords: farmers' choice; extension methods; multivariate analysis; socio-economic traits; Ethiopia

1. Introduction

Agriculture is the activity of a large part of the world's population, both directly and indirectly, and it serves as the foundation for general growth and advancement. Global agricultural production and consumption are expected to increase by 60% between 2005 and 2050 [1]. High agricultural yield without agricultural extension services is unthinkable. According to Elias et al. (2016) [2], agricultural extension services are primarily responsible for elevating rural people's living standards by raising awareness about high-yield agriculture among farming communities. It comprises providing information and advisory services required by farmers to change and improve their family lives and to contribute to the improvement of the quality of production of crop and livestock productivity of commodity quality, to better improve regional or national food sufficiency to the country's trade balance and reduced prices in food markets. Training farmers in better agricultural methods and providing them with improved seeds can be part of extension agents' responsibilities in establishing steps to develop sustainable agriculture [3–5]. This will enable the farmers to pursue their objectives.

Agricultural extension services continue to evolve [6] and have become more pluralistic, relying on multiple delivery mechanisms and governmental and private funding sources [7]. Different extension approaches and methods have been developed to react to farmers' diversified needs and enthusiasm [8], including technology development, market information, agronomic practices, awareness about government/private-run agricultural schemes or programs [6,9–11] and a variety of skills to improve their livelihoods, including Information and Communication Technologies (ICTs) [12] and e-readiness [13]. In this context of evolving extension services, effective communication between extension personnel and farmers is a crucial element [14] as is apparent, for instance, from Snapp and Pound [15], who describe institutional, technical and technological, marginalized groups in society as well as geographical challenges that prevent farmers from taking advantage of all the information presented to them.

Extension methods are the processes and techniques that extension organizations employ to complete their tasks [16]. Many extension programs deploy a multitude of methods such as visits to farms, homes and offices, telephone calls, all kinds of formal and informal meetings (phrased as symposiums, conferences, lectures, seminars, workshops, field days, courses) and social networking [17]. They rely on diverse dissemination practice and tools such as cinema and rural theater [18]; television

programs, radio programs, newspapers, agricultural magazines, news releases, posters, newsletters, agricultural exhibits, extension museums and campaigns [5,19–21]. The selected extension methods depend on the type of information and technology to be disseminated, the number of people to be addressed, the problem to be solved, the extension agent's capacity and the extension method [22,23]. Others provide specific technologies to meet the farmer's interest [24].

The effectiveness of the applied extension methods depends, among others, on the willingness of farmers to engage in the activities [25]. Therefore, farmers' choice of extension methods plays an essential role in their behavior intent, leading to actual adoption behavior [26]. Furthermore, individual farmers' choices are influenced by agricultural and environmental policies, household survival strategies, household characteristics (family size, age, education and income level), community and societal factors (e.g., economic opportunities and access to extension services), input and output markets as well as the availability of resources [27,28]. Therefore, farmers' choices of extension methods are site- and context-specific.

In its rural and agricultural development and national extension policies, the Ethiopian government has emphasized the importance of agricultural extension [29]. As a result, the country's agricultural extension service has benefited from significant investments and seen improvements in terms of providing inputs, information and training [30,31], and Ethiopia currently has the highest extension agent-to-farmer ratio in the world with around 46,000 extension agents employed [7]. In Ethiopia, extension agents play a crucial role in information transmission and are farmers' significant sources of information and agricultural inputs such as improved seeds and fertilizers [32]. Guided by the Ethiopian Ministry of Agriculture (MoA), they deploy various methods such as informal communication, demonstrations and training regarding knowledge and technical skills. In this regard, Farmers Training Centers (FTCs) are essential instruments. However, despite the various methods deployed, extension services experience efficiency and effectiveness deficiencies and failed to transmit innovative technologies to farmers [33]. A thorough understanding of farmers' choices of these methods and the various factors that explain farmers' appreciation needs to be improved. Therefore, the factors of farmers' choices for agricultural extension methods are site and context-specific, and the available extension methods vary by country and region, understanding how farmers in Ethiopia choose extension methods and integrate them into their decision-making processes is crucial for including their priorities and appreciations into extension services' strategies aiming at optimizing technology adoption.

In this study, we explore how both intrinsic and extrinsic factors impact farmers' decision-making processes when it comes to selecting extension methods. The research examines how these factors interact and shed light on the underlying reasons for farmers' preferences, uncovering the intricacies and subtleties of extension method selection. It elicits farmers' choices on the extension methods utilized by the Ethiopian government through its district-level Agricultural Development Offices (ADOs). It aims to open a new avenue for implementing farmer-focused agricultural extension methods in developing efficient and effective extension services. Starting from the hypothesis that socio-economic and institutional factors influence households' choices of extension methods and deploying quantitative and qualitative methods in two case study areas, we investigate which factors determine households' choice of extension methods and how different socio-economic and institutional characteristics of farmers influence these choices.

A study on farmers' attributes to opt for extension methods in Northwest Ethiopia" adds to our understanding of the factors influencing farmers' decisions to engage with agricultural extension

methods in Northwest Ethiopia. It provides insights into the socio-economic characteristics of farmers that determine their choice of extension methods [34,35]. The study's main contribution lies in its detailed analysis of the determinants that affect farmers' choice of agricultural extension methods. It sheds light on the critical factors that influence the choice of extension methods and farmers, which can help design and implement more effective agricultural extension programs [36,37]. We address the knowledge gap caused by the lack of comprehensive research on the factors influencing farmers' choice of agricultural extension methods in Northwest Ethiopia. While there is some research on the determinants of farmers' interaction with extension agencies [38], there is a need for more detailed and context-specific studies that consider the unique attributes and circumstances of farmers in Northwest Ethiopia. By addressing these gaps, the study can provide valuable insights for agricultural extension service providers, helping them tailor their methods to the needs and preferences of farmers in Northwest Ethiopia [39]. Ultimately, this could lead to the more effective dissemination of agricultural practices, contributing to increased productivity and sustainability in the region's agricultural sector.

The remaining parts of this paper are arranged as follows. The second section describes the materials and methods, including the specification of the model and the description of variables and hypotheses. Section 3 presents and examines the descriptive statistics and econometric model results. Finally, the last section provides the conclusion and recommendations.

2. Materials and methods

2.1. Research site information

The research was carried out in two districts of the Amhara region: Fogera and Mecha (Figure 1 for location and Table 1 for the districts' main features). From Fogera district, Bebekes, Kuharmichael, Woretazureya, Tihuanzakena, Meneguzer, Kuharabo, Kidesthana and Abunakokit Kebelles were included. Furthermore, Ambomesk, Kudmi, Enguti, Amarit, Huletteleta, Bachima, Brakat and Kurtbahir Kebelles[1] were taken from the Mecha district. These districts have been subjected to government-implemented extension programs, assisted by or in collaboration with numerous non-governmental organizations (NGOs) that have carried out and supported these extension efforts [38]. Fogera district is well-known for its rain-fed rice and irrigated vegetable production, while Mecha district has a well-developed irrigation capacity with a comparatively robust local scheme management institutions and decision-making that takes users into account. Most of the Mecha farmers use canal water from the Koga irrigation dam [40,41].The latter is home to the vegetable company Koga Veg (a Belgian-based enterprise that exports fresh fruit and vegetables) [38].The prevalence of irrigation schemes in Mecha and the rapid expansion of rice crops in Fogera have encouraged extension actors to deploy more extension service provisions with various methods, rendering them relevant study sites.

[1] Kebelles are the lowest government structure in Ethiopia.

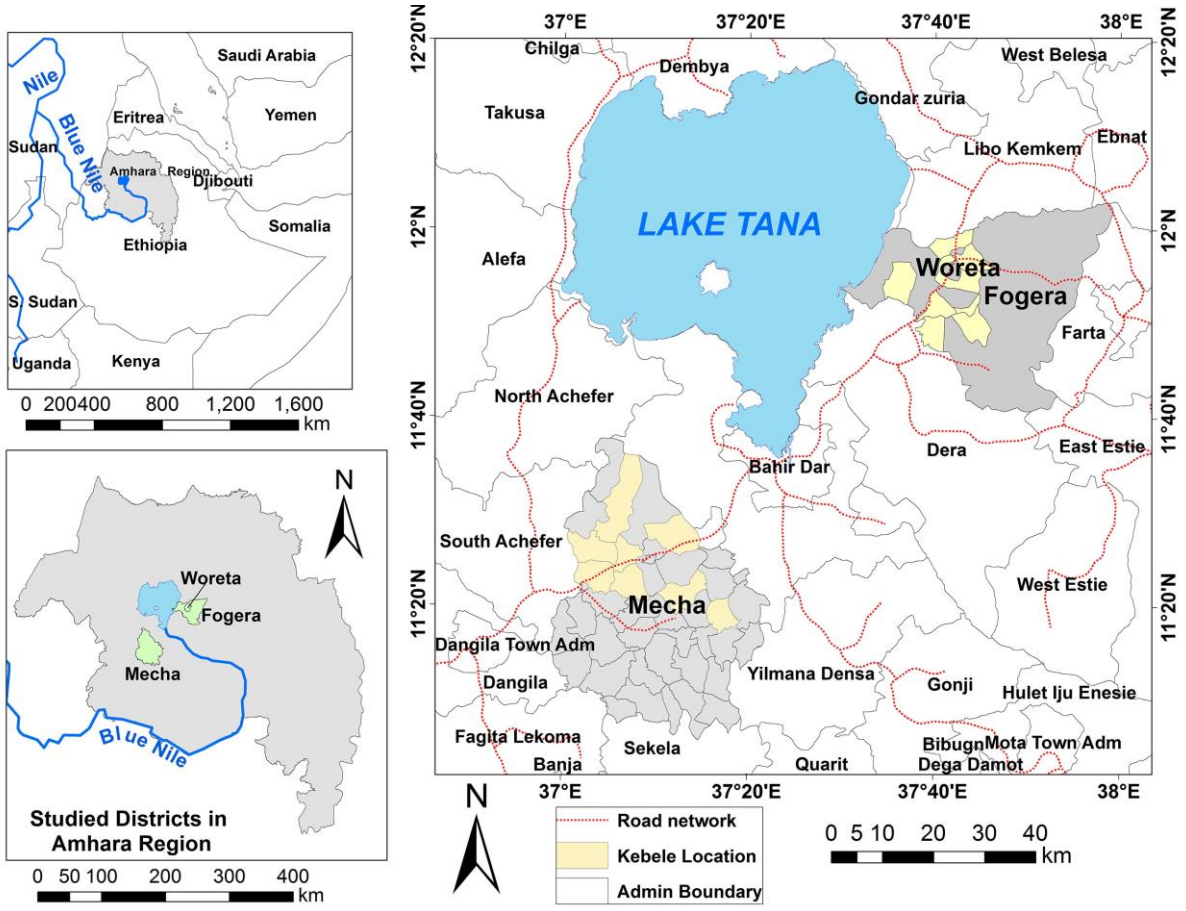

Figure 1. Map of the study area. Sources: Author's compilation.

Table 1. Description of the study area.

Characteristics	Districts	
	Fogera	Mecha
Altitude (m a.s.l)	1774–2410	1800–2500
Temperature in: range (mean)	12–28 (20)	6–31 (18)
Annual rainfall in mm: range (mean)	1103–2400 (1216)	1000–2000 (1700)
Ratio of extension agents to farmers	1:419	1:550
Multipurpose cooperatives(number)	17	11
Dominant crops	Teff, finger millet, maize, rice and noug (Guizatiaabyssinica)	Maize, finger millet, *teff*, barley, pulses and oil crops
Dominant livestock	Cattle, sheep, goats	Cattle, sheep, goats
Total area for all land-uses (ha)	117,414	156,027
Cultivated land (ha)	51,472	72,178
Irrigated land (ha)	13,800	7200
Forest land (ha)	2190	18,547
Grazing land (ha)	26,999	15,591

Source Gebremariam et al. [38]; Arun et al. [42] and Mohammed Kassaw et al.[43].

2.2. Sampling technique and sample size

A multi-stage sampling procedure was used to select farmers for the study. First, the two districts were purposively selected based on the long-term provision of intensive public agricultural extension services. Then, eight kebelles were selected purposively from each district in the second stage. Third, systematic random sampling was employed to select respondents from a list of farmers residing in each kebelle who received agricultural extension assistance in the areas proportionate to the kebelle's size, resulting in a sample of in total 300 households. The sample of farmers we have collected data from is representative of all farmers under study, including their socio-demographic characteristics such as age, gender, income, education level and geographical location. By including a diverse range of farmers in our sample, we can ensure that our study's findings are more accurate and reflective of the farming population as a whole.

2.3. Data collection

For this study, a cross-sectional research design was adopted. A structured questionnaire was developed based on the study's objectives, a literature review and the researchers' vast experience in the field. The questionnaire was delivered to the 300 randomly selected household heads. The household survey questionnaire was conducted to gather data about sample households' demographic and socioeconomic characteristics, institutional services and farmers' choices of extension methods in the study area. A formal survey instrument was prepared, and trained enumerators collected the data from the households via personal interviews. Before full implementation, the structured household questionnaire was pre-tested as a pilot survey in the sample kebelles. The pilot survey ensures that the present questionnaire is relevant and meaningful to the average respondents and decides which questions are relevant for the study. Subsequently, necessary modifications were made based on the feedback from the pre-test. In addition to the questionnaire, an informal survey in the form of focus group discussion and key informants' interviews was employed using checklists to obtain additional supporting information for the study. The focus group discussion assisted the researchers in gaining explicit information and new ideas regarding the determining variables and the extent to which findings would confirm or contradict existing literature.

2.4. Statistical analysis

The data from the questionnaire were coded and organized using STATA software. Descriptive statistics were used to capture the socio-economic and institutional profile of respondents. As detailed below, the determinant variables that influence farmers' choice of extension methods were identified using a multivariate probit model. The extension methods were chosen as outcome variables to represent potential extension method options. The proposed method simulates how the set of explanatory factors affects each of the various extension methods and allows for a possible association between unobserved disturbances and the relationship between the selections of various extension methods.

2.4.1. Specification of the econometric model

The farmers reported that they accessed four methods of disseminating technologies and information. We thus assume that farmers are using these various methods as sources of information simultaneously or separately for various information needs. However, when farmers obtain information from multiple techniques simultaneously, the random error components of the information sources may be associated, and the choices among extension methods are not mutually exclusive. Therefore, we employed a multivariate model that accounts for the possibility of contemporaneous correlation in the decision to access the four separate sources simultaneously.

The linear probability model is the most straightforward one for binary responses. The disturbance terms it encounters take on deterministic and heteroskedasticity properties. Furthermore, given the extreme values of the dependent variables, the estimated probability could be above 1 or below 0 [44]. For the deterministic issue, one might use a maximum likelihood estimation technique, and for heteroskedasticity, one may use either logit or probit estimations [45,46]. A univariate model is the next option; however, this cannot assess any potential association between unobserved disturbances and the relationship between various choices [42]. This issue can be resolved using the multivariate probit model (MVP)

For the analysis of categorical choice-dependent variables, econometric models such as multivariate probit/logit, multinomial probit/logit, conditional or mixed or nested logit are helpful [43]. The MVP is a regression model with a binary response that allows error terms to correlate freely and is used to assess the observed and unobserved effects of numerous independent factors on dependent variables [47–49].

The general specification for the MVP is:

$$y_m^* = x_m'\beta_m + \varepsilon_{m,} y_m = 1\ if y_m^* > 0, 0\ otherwise, m = 1 \ldots., M, \quad (1)$$

$$E\left[\epsilon_m | x_{1,} \ldots., x_m\right] = 0$$

$$Var\left[\epsilon_m | x_{1,} \ldots., x_m\right] = 1$$

$$Cov\left[\epsilon_j \epsilon_m | x_{1,} \ldots\ldots, x_m\right] = \rho_{jm}$$

$$\left(\epsilon_{1,} \ldots\ldots, \epsilon_m\right) \sim N_m[0, R]$$

In this case, y is the dependent variable, m is extension method o,x is a matrix of covariates made up of independent variables, β is an unknown regression coefficients matrix and ϵ_m is a residual error. R is the variance-covariance matrix. The off-diagonal elements in the correlation matrix ρ_{jm} represent the unobserved correlation between the stochastic component of the jth and mth options [50].

Equation (2) calculates the marginal effects of independent variables on the likelihood of choosing various extension methods strategies simultaneously [50]

$$\frac{\partial P_i}{\partial x_i} = \varphi(x'\beta)\beta_{i,} i = 1,2,3, \ldots\ldots, n \quad (2)$$

Where P_i is the probability that event i of extension option will occur, increasing the likelihood

that each extension method choice will be selected, and $\varphi(.)$ is the typical univariate normal density distribution function.

The number of draws necessary to obtain reliable estimates for each observation was set to 100, which is five by default. Ordinary least squares (OLS) estimates were used to conduct the diagnostic tests against each individual's choice variable's identical set of explanatory factors. The variation inflation factor (VIF) test was used to assess for multicollinearity. The VIF value for all independent variables was less than 10, with a mean VIF value of 5.84, indicating no concern for multicollinearity.

2.4.2. Operational definitions

When we state that extension methods are less effective, we mean that farmers need to use their newly gained knowledge/skills. We call extension methods effective if farmers use the gained knowledge/skill most or all of the time [16].

During the field survey, farmers reported turning to four main extension methods (see Table 2). These are training, demonstration, office visits and phone calls. Only a few farmers participated in on-farm trials or individual farm visits or used the distribution of print materials as an extension method. Thus, the four extension methods in this study were selected based on their popularity (the farmers used the frequency methods) in providing information, technology and skill in the research areas.

Table 2. Contextual definitions of extension methods used by farmers in the study area.

No.	Category	Definitions
1	Training	Practical and theoretical agricultural training that supports farmers through capacity-building schemes such as planting methods, irrigation, herbicides, crop rotation and post-harvest storage for grains
2	Demonstration	Demonstrating agricultural technology/practice for better adoption among farmers
3	Office visits	This is the case when farmers visit extension agents' offices for the sake of getting information or inputs
4	Phone calls	When farmers are making a phone call to extension personnel and vice versa to get or provide farm advice or information

Source: Suvedi et al. [51].

2.4.3. Description of variables and hypotheses

Table 3. Summary of the description of the dependent and explanatory variables used in the multivariate probit model.

Variable	Description
Dependent variables	
Training	1 if the household chooses training, 0 otherwise
Demonstration	1 if the household chooses demonstration, 0 otherwise
Office visits	1 if the household chooses Office visits, 0 otherwise
Phone calls	1 if the household chooses phone calls, 0 otherwise

Continued on the next page

Variable	Description
Independent variables	
Sex of the household head[2]	1 if the sex of the household head is male, 0 otherwise
Farm experience	Total number of years in farm business
Active labor force	Total number of active labor participants in the household/family
Dependents in the household	Total number of dependents in the household/family
Formal education	0 if the education level of the head of household is illiterate, 1 able to read and write, 2 finished primary school and 3 finished at least secondary school
Farmers' participation in non-farm activities	1 if the household participates in non-farm activities, 0 otherwise
Access to monetary loan	1 if the household has access to monetary loan, 0 otherwise
Access to mobile phone	1 if the household has access to a mobile phone, 0 otherwise
Access to radio	1 if the household has access to a radio, 0 otherwise
Membership of Idir[3]	1 if the household has a membership of Idir, 0 otherwise
Membership of Mahibere[4]	1 if the household has a membership of a Mahiber, 0 otherwise
Membership of cooperatives	1 if the household has a membership of a cooperative, 0 otherwise
Access to irrigation	1 if the household has access to irrigation, 0 otherwise
Wealth status	0 if the household is poor, 1 mediu, and 2 better-off
Distance to the nearest extension agent's office	Total distance to the nearest extension agent's office in walking minutes

Sources: Authors' compilation.

Hypothesis and definitions of variables

Dependent variables

The binary dependent variable is measured by the probability of farmers choosing extension methods or not. It was represented in the model as Y1 for those households who choose training as the extension method, Y2 for households who choose demonstration, Y3 for households who opt for office visits and Y4 for households who go for phone calls as an extension method.

Independent variables

The explanatory variables hypothesized to influence the choice of extension methods were the following (See Table 3):

Agriculture for subsistence and food security remains gendered in Ethiopia, particularly amongst the country's poorest farmers, with male smallholder farmers more easily reaching subsistence and food security than females [52,53], and because of social and cultural values, women have less access

[2] In Ethiopian case sex categorize only male and female.

[3] Idir is a non-formal insurance that protects against various risks, including funeral expenses, livestock losses, medical expenses and food shortages.

[4] Mahiber is a self-help religious group that members for their shared interests.

to external inputs, services and information [54]. Hence, the "sex" of the household head is a dummy variable taking a value of 1 if the household head is male and 0 otherwise. In addition, male farmers have a higher probability of recruitment and participation in training and demonstrations, owning mobile phones and having access to agricultural offices to seek information and knowledge [55]. Therefore, the sex of the household head (male) was expected to positively affect the choice of extension methods.

"Farm experience" is a continuous variable that measures the number of years the households had been farming at the time of the interview. Farmers' experience is an important factor in adopting and evaluating new technologies and extension methods and increases the likelihood of adopting agricultural technologies [56]. Hence, the assumption was that the farm experience of the household head positively determines the choice of extension methods.

The "active labor force" in a household is a continuous variable that measures the household's number of active labor forces engaged in farming. Family members are the primary labor suppliers for farming operations and are valuable resources for smallholder farmers [57]. Teklewold, Mekonnen [58] argued that farmers with larger households are more ready to accept those new technologies that are more labor intensive. This is because farmers with larger households have access to more family labor, which helped the adoption of improved technologies. The availability of active labor in the household is expected to have a significant and positive influence on the choice of extension methods.

The "household dependents" is a continuous variable that measures the number of dependents in a household. Dependents are household members who provide little or no labor to farming operations but rely on household resources for survival those less than 15 years or more than 64 years old [36,55]. The number of dependents in a household is hypothesized to negatively affect the household head's choice of extension methods.

"Formal education" is a categorical variable that refers to the education level of the household head and is specified as illiterate, able to read and write, completion of primary school and secondary school. As Mwololo, Nzuma [55] demonstrated with regard to Kenya, the household head's educational level has a positive and significant correlation with the farmers' choice of extension methods. Therefore, it is assumed that the more educated farmers are, the more likely they are to choose the extension methods as effective.

"Farmers' participation in non-farm activities" is a dummy variable that refers to whether a household participates in non-farm activities or not. Although agriculture is the primary source of income and employment in most rural areas of developing countries, rural households are increasingly making a living from non-farm activities [55]. Therefore, farmers' participation in non-farming occupations is hypothesized to influence farmers' choice of the extension method negatively, positively or no effect.

"Access to monetary loan" is a dummy variable with a value of 1 if the household has taken a monetary loan and 0 if otherwise. Monetary loan availability benefits farmers by easing capital limitations and allowing them to make timely purchases of inputs that they otherwise could not afford [38]. As a result, farmers with agricultural monetary loans are more likely to choose various extension methods to gain appropriate knowledge on how to enhance their output, secure their income and to repay debts in time. Therefore, the assumption is that access to monetary loan positively affects a household's choice of extension methods.

"Access to a mobile phone" is a dummy variable that takes the value of 1 if the household head has a mobile phone, and 0 if otherwise. Modern ICTs, such as the Internet, mobile phones, television and radio, give relevant and timely information to farmers, and thus makes farm production easier and

more profitable [38,55,59]. Agriculture productivity, socio-economic and institutional circumstances and food security may be enhanced by improved access to mobile phones in a farming community for quick and accurate agricultural knowledge exchange [60]. Therefore, access to mobile phones is assumed to influence farmers' choice of extension methods positively.

"Ownership of a radio" is a dummy variable that takes a value of 1 if the household head has a radio and 0 if otherwise. Lwoga [61] and Mwololo and Nzuma [55] argue that rural radio can be utilized to improve the sharing of agricultural information. Hence, radio access is assumed to positively correlate with the farmers' choice of extension methods' effectiveness.

"Membership of an Idir" is a dummy variable in that if the respondent was an Idir participant, he/she was coded as 1, and 0 if otherwise. Most farmers in rural areas are members of Idir, an insurance and risk-coping mechanism [55]. They can take more risks, such as trying new technologies or new methods, Therefore, it was hypothesized that farmers participating in social organizations like Idir will have a significant positive relationship in choosing extension methods.

"Membership of Mahiber" is a dummy variable in that if the respondent was a Mahiber member, he/she was coded as 1, and 0 if otherwise. Mahiber is a term used for a variety of informal institutions or mutual support networks common in rural areas [55]. In this study, membership of a Mahiber was hypothesized to have a significant positive relationship in choosing extension methods.

"Membership of an official farmers' organization", such as a cooperative, is a dummy variable, with 1 indicating that the farmer is member and 0 that she/he is not. Agricultural cooperatives have been identified as pertinent entities that allow farmers to participate in competitive inputs and output markets, improve agro-food quality and safety, adopt innovative technologies, improve farm economic performance and improve rural household welfare [38,55,59]. Therefore, household membership of cooperatives is hypothesized to influence farmers' choice of extension methods positively or negatively.

"Access to irrigation" is a dummy variable that takes a value of 1 if a household has access to irrigation and 0 if otherwise. In areas where irrigation is prevalent, farmers in Ethiopia produce more than one crop every year, increasing their revenue and consumption while diversifying their farming systems [55]. Hence, it was hypothesized that access to irrigation influences the likelihood of choosing extension methods positively.

"Wealth status of a household" is a categorical variable. The extension agents have responsibility to classify the rural households in the study areas into three wealth ranks (poor, medium and better off) based on their overall physical assets. Better-off farmers are more likely to use different extension methods since they have the means to access the proposed technologies and practices [45]. Therefore, we hypothesized that household wealth will have a positive effect on choice of extension methods.

"Distance to the nearest office of extension agents" is a continuous variable, measured in minutes of walking from the nearest extension agent's office to the household's homestead. The further away a household lives from the extension agent's office, the more difficult and costly it would be to receive advice from the extension agent. Usman [62] reported that distance from the closest office positively and significantly affected accessing extension methods/office visits. Hence, distance from the nearest extension agents' office was hypothesized to affect the choice of extension methods negatively.

2.5. Informed consent

All individuals who participated in the research, including survey households and key informants, were given complete information about the study's objectives. They were approached in a friendly and welcoming manner, and their verbal consent was obtained before their involvement in the study. The researchers made sure to maintain confidentiality with all participants through oral discussions. The questionnaire was specifically designed to gather information relevant to the research objectives, which protected participants' privacy and prevented the collection of personal data. It was also free from degrading, discriminatory or offensive language that could offend the participants. The respondent's identity was not disclosed. Lastly, any phrases, paragraphs, concepts or quotations that were not original to the researchers and were used in the study were fully acknowledged.

3. Results and discussion

The results and discussion section first describe the choice of farmers on extension methods. In part 3.2, we link these with the socio-economic and institutional characteristics of the respondents. Finally, part 3.3 describes the determinants of farmers' choice of extension methods.

3.1. Choice of farmers' extension methods

When asked to rate the effectiveness of extension methods practiced in their locality, the majority of farmers chose training (87.3%) as the most effective method, followed by phone calls (53.1%), demonstration (50.0%) and office visits (37.1%) (see Figure 1). During training, farmers were taught on topics such as planting methods, fertilizer applications, pest and disease management, weed management, irrigation management, post-harvest technologies and marketing information, and linkages between those. This implies that training develops farmers' knowledge and abilities. A similar result has been obtained by Balasubramanya [63], who reported that irrigation management in Southern Tajikistan had been improved due to training. Nyairo [64] recently confirmed that Kenyan farmers acknowledged the effectiveness of the training they received from both state and private agricultural extension service providers about implementing new farming practices to boost yields. Policies should be designed to promote farming practices. Farmers regard cellular phone usage as an imperative source of information and knowledge sharing across social networks since it increases the flow of information between agents, farmers and organizations [65]. Policies should be designed to promote farming practices through training schemes.

The study results demonstrated that training, phone calls, demonstrations and office visits were common avenues for promoting extension technologies, knowledge and skills among rural farmers. However, the discussions nuance these results as they reveal complaints about the lack of extension agents' genuine interest in farmers' issues, because of self-interested reasons such as payments, promotion, benefits and recognition, as evidenced by the agents' disengagement from providing effective training to the farmers they were supposed to serve [66].

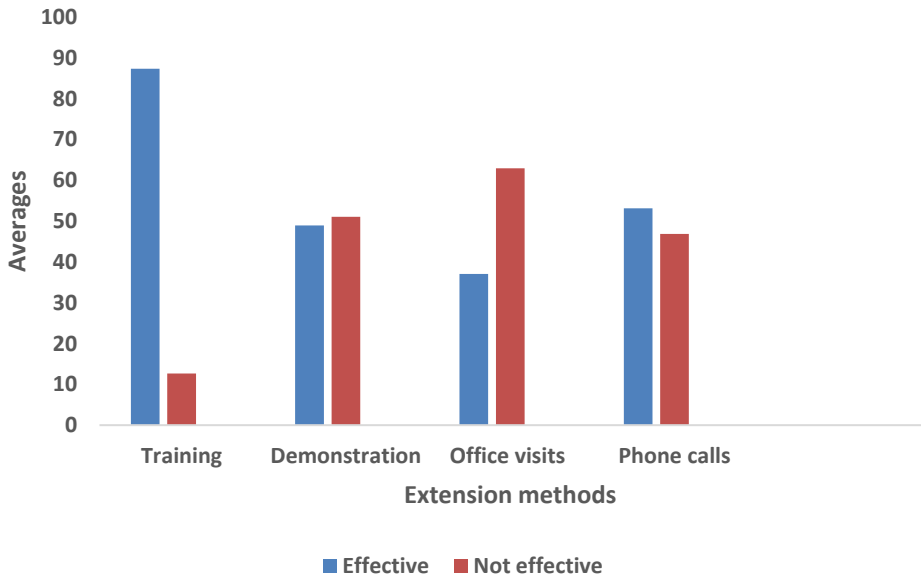

Figure 2. The effectiveness of extension methods.

3.2. Socio-economic and institutional characteristics of the respondents

Table 5 summarizes the major socio-economic and institutional characteristics of the respondents. About 95% of the sampled households are male-headed which is consistent with the 93.4% reported by Abrha, Emanna [67] in Medebay Zana district, Tigray regional state, Northern Ethiopia. The predominance of male-headed households in agricultural activities provided men more opportunities to own farms and contribute to household food security. Most farmers are within an economically active age (average of 43 years old). As young farmers are more open to new technology [68] and given that the average farming experience is 24 years, the farmers are supposed to be open-minded towards or have tried out some promising technologies as young farmers are risk takers. The availability of an active labor force reduces the farms' external labor requirements, which is the predominant situation as the average household has 3 active labor forces and 2 dependents. Two-thirds of the farmers (67%) are literate. Most farmers (81%) do not participate in non-farm activities, implying there are no alternative income-earning opportunities. Most farmers (61%) do not want to take monetary loan from the extension program because they are uncertain about debt repayment and fear of losing collateralized assets. The others (39%) do have access to monetary loan. The research area has an 85% mobile phone ownership rate, implying that mobile phone technology supports farmers in promptly gaining agricultural knowledge and information. 66% of farmers in the study area lack access to a radio, making it impossible for them to hear broadcast extension messages. According to our observation, extension agents employ Idir and Mahiber, which are made up of 87% and 73% of farmers, respectively, to engage with farmers about agricultural information. In the study area, around 74% of farmers are cooperative members, which allows them to connect to value chains and increase their bargaining power. Around 71% of farmers have access to irrigation in the research area. This indicates that farmers have improved their food security through higher productivity, stable output and income. According to this study (Table 1), the majority of male farmers are "medium" (200 or 67%) in contrast to "better-off" (62 or 20%) and "poor" (38 or 13%) farmers. This suggests that farmers

participating in extension activities are more likely to be in the "medium" category. The respondents reported that they lived, on average, 26 minutes away from the nearest extension agent's office. This might imply that farmers living distant from the office were unmotivated to seek information and extension services because it is too time consuming.

Table 4. Socio-economic and institutional characteristics of respondents (n = 300).

Variable (n = 300)		Mean	SD
Farm experience		24.15	10.44
Active labor force		3.30	1.61
Dependents in the household		2.32	1.35
Distance to the nearest extension agent's office		25.61	18.88
Variable	Response	Frequency	Percentage
Sex of the household head	Male	286	4.67
	Female	14	95.33
Formal education	Illiterate	98	32.67
	Read and write	113	37.67
	Primary School	77	25.67
	Secondary school	12	3.99
Farmer's participation in non-farm activities	No	243	81.00
	Yes	57	19.00
Access to monetary loan	No	184	61.33
	Yes	116	38.67
Ownership of mobile phone	No	45	15.00
	Yes	255	85.00
Ownership of radio	No	198	66.00
	Yes	102	34.00
Membership of Idir	No	39	13.00
	Yes	261	87.00
Membership of Mahiber	No	80	26.67
	Yes	220	73.33
Membership of cooperatives	No	77	25.67
	Yes	223	74.33
Access to irrigation	No	88	29.33
	Yes	212	70.67
Wealth status	Poor	38	12.67
	Medium	200	66.67
	Better-off	62	20.67

3.3. Determinants of farmers' choice of extension methods

The Wald test (60) (χ^2 = 117.57 $\rho = 0.000$) is strongly significant at 1% significant level, which indicates that the subset of coefficients of the model is jointly significant and that the explanatory power of the factors included in the model is satisfactory, thus, the MVP model fits the data reasonably well. The simulated maximum likelihood test LRχ2(6) = 134.11 (Prob $>$ χ2 =

$0.000)$ of the null hypothesis of independence between the extension methods decision ($\rho 21 = \rho 31 = \rho 41 = \rho 32 = \rho 42 = \rho 43 = 0$) is significant at 1% significant level. Therefore, the null hypothesis that all the ρ(Rho) values are jointly equal to 0 is rejected, indicating the goodness-of-fit of the model and supporting the use of the MVP model over individual probit model. This verifies that separate estimation of choice decision of these methods is biased, and the decisions to choose the four agricultural extension methods are interdependent household decisions.

Correlation coefficients are used to measure the strength of the linear relationship between two variables. The ρvalues (ρij) indicate the degree of correlation between each pair of dependent variables. The ρ21 (correlation between the choice for demonstration and training), ρ31 (correlation between the choice for office visits and training) and ρ41 (correlation between phone calls and training) are positively interdependent and significant at 1% and10% significant level, respectively. From this finding, it is possible to conclude that the relationship between dependent variables were more likely associated (see Table 5).

Table 5. Estimated correlation coefficients between four extension methods.

Variables		ρ_1	ρ_2	ρ_3	ρ_4
	ρ_1	1			
	ρ_2	0.396***	1		
		(0.108)			
	ρ_3	0.216*	0.553***	1	
		(0.110)	(0.079)		
	ρ_4	0.281***	0.339***	0. 743***	1
		(0.106)	(0.095)	(0.053)	

Note: *** and * indicate statistical significance at 1 and 10, respectively. ρ1 = training, ρ2 = demonstration, ρ3 = office visits and ρ4 = phone calls, Parenthesis in the standard error (SE).

Extension methods facilitate the dissemination of information and knowledge to the end users. The preeminent extension methods, chosen by the farmers in the study area, are training, demonstration, office visits and phone calls. Therefore, this study's null hypothesis is not significantly different between farmers' socio-economic and institutional factors and their choice of extension methods. This means that farmers use a specific extension method regardless of their sex, farm experience, education, etc.

The results indicate that only 10 of the 15 hypothesized explanatory variables included in the model influence farmers' choice. These include the sex of the household head, farm experience, dependents in the household, formal education level of the household head, household head participation in non-farm activities, access to monetary loan, mobile phone, access to radio, membership to Idir and membership of cooperatives. Among these ten variables, sex of the household head, farm experience, dependents in the household, household head participation in non-farm activities, access to monetary loan, mobile phone, access to radio, membership to Idir and membership of cooperatives were postively associated with some farmers' choices of extension, and the remaining one variable showed positive associations (Table 6). Analyses of multivariate probit analysis are given in the Appendix.

Table 6. The marginal effect estimation after multivariate probit analysis.

Variable	Extension Methods							
	Training		Demonstration		Office visits		Phone calls	
	Dy/dx	se	Dy/dx	Se	Dy/dx	se	Dy/dx	se
Sex of the household head	0.062*	0.033	0.020	0.033	0.035	0.032	0.037	0.032
Farm experience	0.024*	0.013	0.015	0.010	−0.003	0.010	−0.004	0.010
Active labor force	−0.003	0.005	−0.004	0.004	−0.001	0.004	−0.004	0.004
Dependents in the household	−0.006	0.006	−0.010**	0.005	0.001	0.005	0.001	0.005
Formal education	−0.025	0.018	−0.033**	0.014	0.001	0.014	0.023	0.014
Farmer's participation in non-farm activities	0.068**	0.028	0.006	0.017	−0.013	0.016	0.015	0.016
Access to monetary loan	0.011	0.016	0.013	0.013	0.022*	0.013	0.016	0.013
Mobile phone	−0.016	0.023	0.025	0.018	0.003	0.018	0.042**	0.019
Access to radio	0.054**	0.020	0.052***	0.013	0.038***	0.013	0.037***	0.013
Membership in Idir	0.007	0.022	−0.028	0.020	−0.065***	0.019	−0.029	0.020
Membership in Mahiber	0.002	0.018	−0.022	−0.015	−0.014	0.015	−0.007	0.014
Membership of cooperatives	0.030*	0.018	0.049***	0.006	0.015	0.016	−0.015	0.015
Access to irrigation	0.007	0.017	−0.002	0.004	0.014	0.015	0.016	0.014
Wealth status	−0.000	0.015	0.000	0.012	0.002	0.012	0.006	0.012
Distance to the nearest extension agent's office	0.001	0.000	0.000	0.000	−0.000	0.000	0.000	0.000

Note: *** = significant at 1%; ** significant at 5%; * = significant at 10%.

The sex of the household head was an important determinant of extension method choice to choose between the training, demonstrations, office visits and phone calls. The result shows that male household heads tend to prefer trainings over demonstrations, office visits and phone calls compared to female household heads. The marginal effects imply that being male household head increases the probability of selecting training by 6.2 percent. Gender difference is one of the factors influencing the choice of extension methods due to many socio-cultural values and norms, males have freedom of mobility and participation in different extension programs and consequently have greater access to information. The result is in line with Sumo, Ritho [69] that males are key decision-makers in most households in Liberia. To better serve the agricultural community, it is essential to develop extension methods that cater to male and female farmers' unique needs and preferences. These services should be designed to address the specific challenges farmers of both genders face in the industry. It is also essential to ensure these services are accessible and inclusive to all, regardless of gender.

The farm experience of the respondents positively influenced the likelihood of household heads choosing training at 5% levels of significance. The finding revealed that as the experience of farmers

increases by ten years, the probability of choosing training as an extension method would be increased by 24%. One probable explanation is that experienced farmers serve as model farmers[5], and extension agents routinely train and widely use them to disseminate agricultural information and technology to other farmers, as a strategic way to reach many small farmers across the Kebelle. Similar results were obtained by Hailemichael and Haug [70], who found that Ethiopia's whole extension service delivery system is arranged in such a way that agricultural knowledge and technology originating from various institutes are first conveyed through a talk-with-client method to model farmers, who subsequently disseminate the information to follower farmers. The policy can use experienced farmers as model farmers to train and disseminate agricultural information and technology can effectively reach many farmers in the community.

Farm households having more dependents negatively and significantly affect the choice of demonstration as extension methods at a 5% significant level. The likelihood of selecting demonstration as an extension method would fall by 10% for every ten decreases in the number of dependents. This shows that only other variables constant when there is a larger labor pool available can the farmers take part in farm demonstrations. Farmers could have somebody to cover their farm work to participate in an event demonstration. For instance, farmers needing help looking for their animals have been compelled to give up and participate in farm demonstrations in Egypt [71]. Policymakers should, therefore, consider designing extension methods tailored to the specific needs of households with multiple dependents to ensure they are not left behind.

Education level of households have a significant and negative effect on the chances of choosing demonstration extension methods choice at 5% significant level. Education is believed to give individuals with the necessary knowledge that can be used to collect information, interpret the information received and make decision. Even though unexpected result is found, this result shows that farmers who complete secondary school would less likely to choose demonstration than other extension methods. One possible explanation is that educated farmers envision themselves as better off, hence viewing participation in demonstrations as below their capacity and need. In contrast, demonstrations were prepared and coordinated by extension organizations to encourage illiterate farmers to embrace modern farming methods. Furthermore, this outcome is most likely due to the different kinds of demonstration events, with some being focused on and delivered solely to a specific group of farmers and other more generic events being open to all farmers. This finding thus confirms previous research underlying that organizing demonstrations differs according to "the actors/networks involved and their roles, the audience/ attendees, the network structure and its characteristics, resources, finances and incentives and characteristics related to the farm (geographic location, accessibility, etc.)" [72]. Design extension methods that cater to farmers' specific needs and preferences at different education levels. This may involve offering more advanced or specialized training for educated farmers and more fundamental or practical demonstrations for less educated farmers.

Farm households allocate a portion of their labor outside crop production, such as temporary salaried workers and other non-farm activities. Remarkably, the likelihood of choosing a training was positively affected by the household's participation in non-farm activities at a 10% significance level. As a farmer is involved in non-farm activities, the probability of choosing a training will increase by

[5] Model farmers are thought to be more productive than other farmers and they are expected to share their knowledge with others through peer-to-peer learning in farmer networks.

6.8%. The probable reason is that farmers involved in non-farm activities may have the financial capacity to adopt the trained technology that requires economic issues. As a result, as the household head engages in non-farm activities, their preference for training as an extension method grows due to the financial ability to implement an innovation following the training. These results are in line with studies by Dapilah, Nielsen [73], who found that farmers' engagement in non-farm activities increases the probability of participation in a training of northern Ghana. It is important to acknowledge by policy makers that farmers who have diverse sources of income, including non-farm activities, may have unique needs and capabilities compared to farmers who rely solely on crop production. As a result, it may be necessary to develop extension methods that are flexible and adaptable to the varying needs of different farmers.

It is acknowledged that small-scale farmers might enhance their capital base is by having access to monetary loans. At a 10% level of significance, access to monetary loans considerably and positively influences households' decision to use office visits as an extension method. Monetary loan access enables farmers to boost output by investing in agricultural supplies like fertilizers and insecticides. According to the findings of the study, when all other factors are held constant, having access to monetary loans increases the possibility that people will choose office visits as a means of extension method by 2.2%. The most likely explanation is that extension agents' offices are where farmers typically purchase agricultural inputs. The offices act as locations for distribution, payment and registration. Similar results have been witnessed by Norton and Alwang [7] pointed out that farmers are more pleased with the guidance and information they receive about monetary loans after visiting the offices. It's important to acknowledge by policy makers to ensure that extension offices provide valuable information and resources related to financial management and agricultural inputs. This could involve offering consultations on accessing credit.

Demand for agricultural advice is high, and farmers have a real need to access market information farm management information and knowledge on management of pests and diseases, pesticide use and management.

Owning mobile phone influenced the choice of phone calls positively and significantly at a 5% significance level. The marginal effects results indicated that household heads owning mobile phones were 4.2% more likely to choose phone calls than those who do not have mobile phones. This means that farmers who had access to or owned mobile phones had high probability of choosing phone calls as an extension method. In order to effectively reach farmers in remote areas, it is crucial to implement a multifaceted approach. This approach should include using digital technologies such as mobile apps, SMS messaging and online platforms to provide farmers with access to information, resources and support [37]. Innovative extension models such as community-based programs, farmer-to-farmer mentorin, and participatory learning and action can also effectively engage and empower farmers in remote areas [74]. Additionally, targeted communication strategies are essential to ensure farmers know the available resources and services. This can include using local media outlets, community meetings and social networks to disseminate information and promote awareness [75]. By combining these approaches, extension outreach can be significantly improved in remote areas, leading to increased productivity, sustainability and overall well-being for farmers and their communities [6]. According to Goodier and Gebeyehu [76] smallholder farmers can access the 8028 Farmer Hotline by calling the code 8028 in Ethiopia and receive information on agricultural activities on all significant cereal, pulses and high-value crops on land preparation, technology use, cultivation method, irrigation, generally, from pre planting until harvesting [77]. The results agree with findings from Arun and Yeo

(2019) who reported a positive influence of phone calls on the impact of farmers' climate Risk perception and socio-Economic attributes on their choice of ICT-Based Agricultural Information Services: Empirical Evidence from Pakistan. Policymakers should encourage and support farmers to acquire and use mobile phones for accessing agricultural information.

Access of radio of farm households had a positive and significant effect with all four choices of extension methods. Thus, training, demonstration, office visits and phone calls are significant at 5%, 1%, 1% and 1% significance levels, respectively. As access of radio increased, the probability of choosing training, demonstration, office visits and phone calls also increased by 5.4%, 5.2%, 3.8% and 3.7%, respectively. This implies that the decision to use a radio by rural farmers in extension and advisory services stemmed from the realization that radio is an excellent, cost-effective technique for raising awareness of the different extension methods stated above. Radio usage stimulates farmers to participate in various extension methods. Farmers in rural areas can benefit from radio access through community radio, which can play a significant role in rural development at the grassroots level [78]. Farm Radio International works with partners with radio broadcasters to improve food security and agricultural methods for small-scale farmers and rural communities in African countries [79]. They provide resources and training opportunities for broadcasting partners to create a programming schedule that caters to the needs and interests of the local farming community [79]. Farm Radio International has successfully achieved its objectives by providing agriculture and allied sector information based on the farming communities' needs [80]. This result is consistent with Moussa and Otoo [81], who found that those farmers from west Africa receiving radio messages are 23% more likely to attend demonstrations about the triple-bag technology than those not receiving radio messages, holding all else constant.

Membership of Iddir negatively affected the choice office visit at 1% significance level. As a household head member of Iddir, the probability of choosing demonstration and office visits decreased by 6.5%. These findings contradict the findings by [82] who found that social membership is important to increase the chance of choosing extension methods in Ethiopia. However, the discussion with farmers revealed that aside from performing funerals, traditional associations such as Iddir have little tendency to contribute to joint development activities. This might be because Iddirs legal bodies were not adequately informed about events, or not encouraged to invite their members to join. Policymakers should encourage active participation in extension methods and development activities by community members, including Iddir members.

Belonging to a cooperative positively affected the probability of choosing training and demonstration as an extension method, at a 10% and 1% significance level, respectively (Table 6). Delivering technical education to boost member farmers' productivity and profitability and training members on best practices in using agricultural technology is critical for cooperative members. Therefore, membership in cooperatives increases the probability of perceiving training and demonstration as an extension method by 3% and 4.9% respectively. The result contrasts with Ofori, Sampson [83] who show that farmers who are not members of rural cooperatives benefit from the improved capacity of extension agents and demonstration trials and training, indicating that farmers with limited information sources tend to benefit more from the introduction of alternative information transmission methods. Policymakers should consider the potential benefits of cooperatives when developing and implementing extension methods. Proper consideration of this model can lead to more effective and sustainable solutions.

4. Conclusions

The study concludes that farmers' socio-economic and institutional features should be taken into consideration when choosing and employing agricultural extension methods. It endorses the importance of personal and household attributes and socioeconomic and institutional factors in selecting extension methods. It was clear from farmers' responses that specific extension methods are widespread. Although most farmers (87.3%) chose training as an effective extension method, their choice of demonstration, office visits and phone calls is rather low. Multiple and interrelated factors highly inhibited or encouraged their choice. The main factors include, sex of the household head, farm experience, monetary loan access, owning mobile phone, education level of farmers, participation of farmers in non-farm activities, access to radio, farmers' membership of an Iddir, membership in cooperatives and distance to the nearest extension agent's office.

Our research solely looks at farmers' choices with four extension methods: Training, demonstration, office visits and phone calls. However, therefore, other extension methods beyond those that this research has covered should be considered in future research and should consider other variables that encourage and inhibit smallholders' choice of extension methods. Finally, we have researched from the demand side'; however, the supply side factors are also important such as content of the extension information, knowledge and skill of the extension agents, time of delivery etc. Future research must thoroughly analyze the various factors that influence smallholders' choice of extension methods. To achieve this, it is imperative to consider both the supply and demand factors that are at play in the decision-making process. The supply factors include the availability of resources access to information and knowledge, while the demand factors include the smallholder farmers' needs, wants and preferences. A thorough understanding of both the supply and demand factors will help identify the factors that encourage or inhibit smallholders' choices of extension methods.

There is a need to establish contextually relevant and pro-poor extension methods that enable poor farmers to participate in extension methods and encourage them to co-design them. Overall results indicate that the farmers' willingness to accept various extension methods was strongly correlated with socio-economic and institutional factors.

As a result, any extension method plans should consider farmers' choices and factors impeding before implementing the methods. In addition, farmers' awareness should be raised of the overall benefits and challenges of the methods. In the same way, newly introduced extension methods should be integrated with farmers' contexts following a bottom-up approach where farmers participate in all extension method decision-making. Moreover, we conclude that the specific socio-economic circumstances of farmers and institutional factors need to be considered in the development of measures and policies that aim to encourage farmers to choose extension methods and also, service providers should tailor their services to the farmers' socio-economic characteristics.

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Use of AI tools declaration

The authors declare that they have not used Artificial Intelligence (AI) tools in the creation of this article.

Conflict of interest

The authors declare no conflicts of interest in this paper.

Supplementary

Appendix Table 1. Multivariate probit estimations for factors influencing farmers' choice of extension methods.

Variables	Extension methods			
	Training	Demonstration	Office visits	Tele calls
Sex of the household head	0.802*(0.437)	0.255(0.426)	0.456(0.414)	0.463(0.403)
Farm experience	0.314*(0.171)	0.190 (0.126)	−0.036(0.123)	−0.050(0.121)
Active labor force	−0.038(0.062)	−0.053(0.052)	−0.019(0.050)	−0.053(0.050)
Dependents in the household	−0.076(0.078)	−0.122*(0.063)	−0.008(0.062)	−0.015(0.059)
Formal education	−0.329(0.238)	−0.418**(0.183)	0.018(0.184)	0.290(0.181)
Farmers' participation in non-farm activities	0.882**(0.377)	0.072(0.213)	−0.172(0.212)	0.192(0.207)
Access to monetary loan	0.015(0.211)	0.167(0.163)	0.279*(0.163)	0.203(0.160)
Mobile phone	−0.212(0.305)	0.313(0.234)	0.037(0.234)	0.526(0.240)
Radio	0.705***(0.263)	0.658***(0.172)	0.497***(0.169)	0.465**(0.166)
Membership of *Idir*	0.088(0.290)	−0.361(0.251)	−0.843***(0.252)	−0.367(0.259)
Membership of *Mahiber*	0.025(0.233)	−0.286(0.185)	−0.189(0.184)	−0.089(0.182)
Membership of cooperatives	0.394*(0.236)	0.627***(0.196)	0.081(0.197)	−0.187(0.192)
Access to irrigation	0.087(0.228)	−0.044(0.189)	0.055(0.177)	0.206(0.173)
Wealth status	−0.002(0.194)	−0.014(0.161)	0.026(0.151)	0.072(0.149)
Distance to the nearest extension agent's office	0.010(0.006)	0.002(0.005)	−0.002(0.004)	0.002(0.004)
Constant	−0.411(0.662)	−0.790(0.581)	−0.210(0.581)	−0.859(0.566)
Observation	300	300	300	300

Likelihood ratio test of rho21 = rho31 = rho41 = rho32 = rho42 = rho43 = 0: chi2(6) = 133.76, Wald chi2(60) = -555.76, Prob > chi2 = 0.0000, Robust standard errors in parentheses. *, ** and *** = significance level at 10, 5 and 1%, respectively.

Appendix Table 2. Error covariance matrix and correlations of the MVP model.

Correlations	Correlations coefficients	Standard errors	Z	Pr > z
atrho21	0.419	0.128	3.26	0.001***
atrho31	0.219	0.116	1.89	0.059*
atrho41	0.289	0.116	2.50	0.012**
atrho32	0.622	0.114	5.45	0.000***
atrho42	0.353	0.107	3.30	0.001***
atrho43	0.957	0.119	8.04	0.000***
rho21	0.396	0.108	3.66	0.000***
rho31	0.216	0.110	1.95	0.051*
rho41	0.281	0.106	2.64	0.008***
rho32	0.553	0.079	6.96	0.000***
rho42	0.339	0.095	3.58	0.000***
rho43	0.743	0.053	13.94	0.000***

Likelihood ratio test of rho21 = rho31 = rho41 = rho32 = rho42 = rho43 = 0: chi2 (6) = 133.76, Wald chi2 (60) = −555.76, Prob > chi2 = 0.0000, Robust standard errors in parentheses *, ** and *** = significance level at 10, 5 and 1%, respectively.

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