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Research Article

Drivers of agricultural extension service delivery on soil and water conservation practices: evidence from North-Western Amhara Region, Ethiopia

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Abstract: *In Ethiopia, the successful implementation of Soil and Water Conservation (SWC) practices relies on the efforts of Development Agents (DAs) who provide support and guidance, as well as the willingness of farmers to adopt these practices. Hence, this study aimed to assess farmers' opinions on the adequacy of SWC extension services; identify factors affecting the job performance of DAs; and identify factors affecting farmers' receipt of SWC extension services. The study was conducted in the Western Amhara Region of Ethiopia in three administrative zones. Data were collected using a questionnaire survey, a self-administered questionnaire, and a checklist from nine kebeles, comprising 383 and 87 randomly selected farmers and DAs, respectively. The study found that farmers perceived DAs have been performing adequately for only approximately 40% of all types of SWC extension services. The result also confirmed that DAs have been performing effectively for only 35.7% of all types of SWC extension functions and the remaining 64.3% of the extension functions were poorly performed. Multiple linear regression model results confirmed that sex, age, and work experience have are negatively related to DA's job performance, whereas educational qualification has is positively related. On the other hand, the model confirmed that sex and land holding size has been negatively related to farmer's' receipt of SWC extension service, whereas age, cosmopolitanism, and social participation are related positively. Therefore, the study concludes that farmers' demand-driven extension service delivery is more effective when the above- listed farmers' personal, socio-economic and institutional characteristics are addressed and policies and legal frameworks are in place to guide the extension service delivery. The Amhara National Regional State should deliver hands on trainings for DAs to enable them and upgrade the knowledge and skills in the areas of SWC practices.*

1. Introduction

Ethiopia relies heavily on agriculture, which contributes 47% of its GDP, provides 80% of employment, and accounts for 60% of export commodities. This means that a country's economic development depends greatly on the growth of its

agricultural sector (World Bank, 2011). Agricultural extension services, which are part of the sector's support system, play a crucial role. It not only assists in the development of the sector but also contributes to the development of human and social capital. These services work with farmers to promote Soil and Water Conservation (SWC). This indicates that agricultural extension services have a wider impact than traditional roles (Swanson et al., 2008).

The successful implementation of SWC practices in agricultural extension services relies on the efforts of Development Agents (DAs) who provide support and guidance, as well as the willingness of farmers to adopt these practices (Oakley and Garforth, 1985). The role of DAs in the delivery of agricultural extension services related to SWC practices includes organizsing training sessions, offering technical advice, and facilitating the distribution of resources needed for SWC practices (Moris, 1991). The way DAs interact with farmers and farmers perceive the DA's' extension services as helpful and crucial to bring changes in SWC practices. Furthermore, the adequacy and type of agricultural extension service could be used to determine the effectiveness of DAs in transferring the knowledge and skills required by farmers to improve SWC practices (Bakri, 1991).

Research findings show that the effectiveness of extension personnel is measured by the level of awareness of extension services created among farmers, the number of farm visits, and the percentage of scheduled meetings held between farmers and DAs. Furthermore, events held by DAs, such as the number of field meetings, regularity of meetings, number of field days and demonstrations organizsed (monthly, quarterly, annually), number of supervisory visits, number and regularity of research-extension linkage workshops, and farmer training sessions are manifestations of effective DAs (Alilal, 2012).

In Ethiopia, the main role of DAs in SWC practices is to establish and assist SWC groups, advice and teach farmers on the importance of integrated measures, demonstrate key recommendations, and provide training on SWC practices. Despite these efforts, the adoption of SWC practices remains low, leading to

land degradation (Lokina et al., 2011). While some studies on SWC have been conducted in the Amhara Region, few have addressed factors that influence the effectiveness of the delivery of agricultural extension services. The focus of these studies was on the technical aspects of the physical limitations of the land (for example, slope, soil texture, and soil depth) and erosion risks (Abera, 2013; Shimeles, 2012; Birru, 2007). Emphasis was placed on enhancing technical aspects (protective functions of SWC practices, either conserving the water and the soil or draining the water). In these studies, the needs, social, cultural, organizational, institutional, and economic circumstances of land users and Development Agents and their effect on the delivery of agricultural extension services were not adequately considered (Abate, 2011).

The establishment of farmers' and DAs' personal, socioeconomic, and institutional determinants influencing the delivery of extension services on SWC practices is essential for taking measures to alleviate the constraints affecting the application of key recommended SWC practices. The identification of factors that accelerate the effectiveness of extension service delivery on SWC practices can enhance the formulation and implementation of SWC technology dissemination programs. In addition, researchers and extension specialists can use the results of this study to modify research and extension activities. Policymakers can benefit from this study because they require micro-level information to formulate suitable policies. The current study, therefore, intended to establish farmers' and DAs' personal, socioeconomic, and institutional determinants to guide the effective delivery of agricultural extension services on SWC practices.

2. Review of related Works
2.1. Basic concepts of individual job performance
Scholars agree that performance must be considered a multidimensional concept. When evaluating job performance, the behavioural aspect and outcome aspect are two important perspectives to consider (Borman and Motowidlo, 1993; Roe, 1999). The behavioural aspect of job performance focuses on the actions, behaviours, and skills demonstrated by an individual in their role. This perspective emphasizes the processes and efforts involved in performing job

tasks. For example, agricultural Development Agents (DAS) provide training, create awareness, and demonstrate how farmers practice soil and water conservation techniques.

The outcome aspect of job performance focuses on the results and achievements of an individual in their role (Campbell, 1990). It assesses the tangible outcomes and measurable targets that have been met or exceeded. This perspective emphasizes the outcomes and goals achieved as a result of an employee's efforts. For instance, agricultural Development Agents enhanced the adoption rate of soil and water conservation practices by 30%. Empirically, behavioural and outcome aspects are related. Ideally, a well-rounded evaluation of job performance should consider both aspects as they provide complementary insights into an employee's overall effectiveness in their role. This study focuses on behavioural aspects to evaluate the performance of DAs in SWC extension services.

2.2. Measurement of individual job performance

Various measurement options have been used over the years to evaluate job performance. These measures include rating scales, tests of job knowledge, hands-on job samples, and archival records (Viswesvaran et aI., 1996). Among these options, performance ratings such as peer and supervisor ratings are the most commonly used ratings. Researchers have concluded that supervisory ratings show higher inter-rater reliability than peer ratings (Harris and Schaubroeck, 1988; Viswesvaran et aI., 1996). Hence, this study employs supervisor ratings to evaluate the job performance of Das.

2.3. Conceptual framework

Asika (2003) sees a model as simply an attempt at classifying the major elements of an entity or phenomenon with regards to their functions and inter-relationship to observe more closely causal relationships. The model developed for this study is based on the orientation of innovation-diffusion theory; it starts by examining the farmers' personal, socio-economic, and institutional factors as influencing the adoption of innovations. Ovwigho (2011) stated that the adoption of innovations has remained the major yardstick for determining the success or impact of agricultural extension services on the intended beneficiaries. The innovation-diffusion theory also examined DA's personal and socio-economic characteristics, which influence their job performance. It was assumed that the job performance of the DAs is a measure of the effectiveness of agricultural extension service delivery on SWC practices. Effectiveness in this study is influenced by farmers' and DA's personal, socioeconomic, and institutional indicators (Rogers, 2005). Therefore, the relationship between farmers' and DAs', socioeconomic, and institutional determinants and the effectiveness of delivery of extension services on selected SWC practices were drawn (Figure 1).
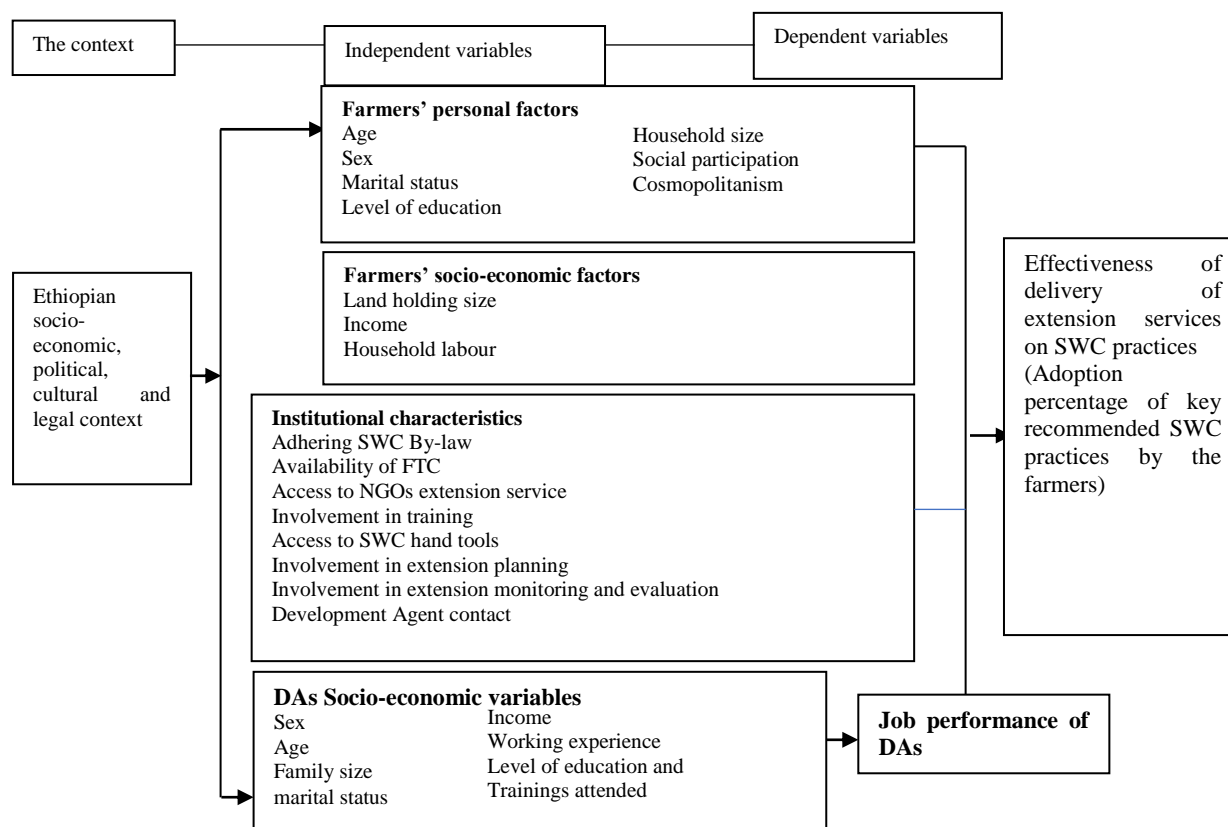
The context	Independent variables	Dependent variables

Farmers' personal factors

Age	Household size
Sex	Social participation
Marital status	Cosmopolitanism
Level of education	

Farmers' socio-economic factors
Land holding size
Income
Household labour

Ethiopian socio-economic, political, cultural and legal context

Institutional characteristics
Adhering SWC By-law
Availability of FTC
Access to NGOs extension service
Involvement in training
Access to SWC hand tools
Involvement in extension planning
Involvement in extension monitoring and evaluation
Development Agent contact

Effectiveness of delivery of extension services on SWC practices (Adoption percentage of key recommended SWC practices by the farmers)

DAs Socio-economic variables

Sex	Income
Age	Working experience
Family size	Level of education and
marital status	Trainings attended

Job performance of DAs

Figure 1: Conceptual framework

3. Materials and Methods

3.1. Description of the study area

This study was conducted in three zones in the Amhara National Regional State of Ethiopia. The study areas, North Gondar, South Gondar, and West Gojam Zones are approximately 747 km, 660 km, and 560 km away from the Ethiopian capital city, Addis Ababa, respectively (see Figure 2). The western Amhara region is characterized by a high population density.

The population of the region was estimated to be 10.33 million in 2015, of who 5.18 million were males and the rest were females (ANRS-CoP, 2015). With an estimated area of 79,586.83 square kilometers, this region has an estimated density of 129.9 people per square kilometer, which is higher than the national average, which is 84 people per square kilometer (CSAE, 2015).
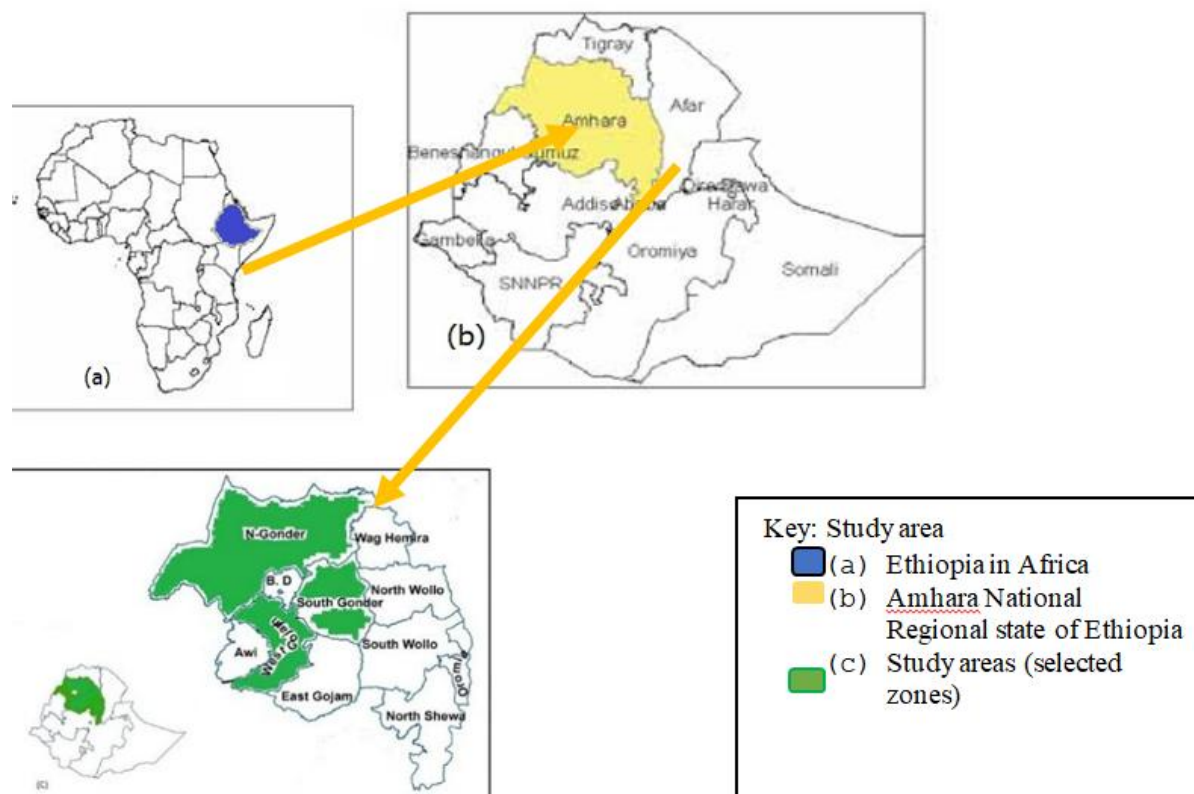
Figure 2: Map of the study area

Source: ANRS-CoP (2015)

3.2. Sampling procedure and sample size determination

There are ten zones in the Amhara Region, five of which are found in the western Amhara Region. Three zones from this region were purposively selected based on the level of SWC practice implementation. The selected zones performed better on SWC practices, which would help obtain information. One representative district from each zone was selected (i.e., Mecha district from west Gojjam zone, Farta from south Gonder, and Lay Armacheho from north Gonder), making a total of three districts based on the level of implementation of SWC practices. Three kebeles were randomly selected from each district using the lottery method, resulting in a total of nine kebeles providing equal chances. The sampling unit or basic unit of analysis was the household and DAs. Therefore, the lists of households in the Kebele registers and the list of DAs in the district office of agriculture were used as a sampling frame. Households were selected with proportional random sampling for this study from the list of households

3.2.1. Sample size determination for households

For this study, households or household heads represent farmers. A total of 383 households were selected with proportional random sampling for this study from the list of households based on the formula indicated below. Sampled households were 41, 42, 57, 56, 64, 48, 22, 16 and 37 from Wewa, Saharna, Werken, Enamirt, Kurt Bahir, Midre Genet, Kerker Bal Egzihaber, Aynet weha and Chera Ambezo kebeles, respectively. For a finite population or or a small population below 10,000, in this study is 9235, correction for proportions is done (Cochran, 1963). Thus, the sample size can be adjusted (the finite population correction) using the following equation:

$$n = {n_0}/{1 + (n_0 - 1)/N} \qquad (1)$$

Where:

n = the required sample size

N = the population size = 9235

n_0 = sample size for infinite population (385)

3.2.2. *Sample size determination for development agents*

The lists of the Development Agents in the district registers were used as sampling frames. This study selected Development Agents who specialised in SWC for the self-administered questionnaire. Therefore, one Development Agent was assigned to each every 115 kebeles specialised in SWC practices, making a total of 115, which is the target population

for this study. From this, a total of 87 Development Agents were selected with proportional random sampling (Table 1) and based on the formula by Yamane (1967), which constituted the sample size.

Sampled Development Agents were 32, 30, and 25 for Mecha, Lay Armacheho, and Farta districts, respectively. Yamane (1967) provides a simplified formula to calculate sample sizes. A 95% confidence level, P = 0.5, and e = 0.05 are assumed for the Equation.

$$n = {N}/{1 + N(e^2)} \quad \dots\dots\dots \text{ Equation (2)}$$

Where:

n is the sample size, N is the population size, and e is the level of precision

Table 1: Sample size of Development Agents (DAs)

Name of districts	No. DAs	Proportion of DAs to the population (%)	No. sampled DAs (n)		Total (n)
			Male	Female	
Mecha	43	37	22	10	32
Lay Armacheho	39	34	22	8	30
Farta	33	29	16	9	25
Total	115	100	60	27	87

Accordingly, 383 farmers and 87 DAs were selected. The survey data were collected in 2014. Ethical approval for the collection of data was achieved from Research Ethics Review Committee of the College of Agriculture and Environmental Sciences, Bahir Dar

University. Informed consent (written) was obtained from all respondents in the data collection process. Figure 3 summarizes the sampling procedure implemented in the present study.
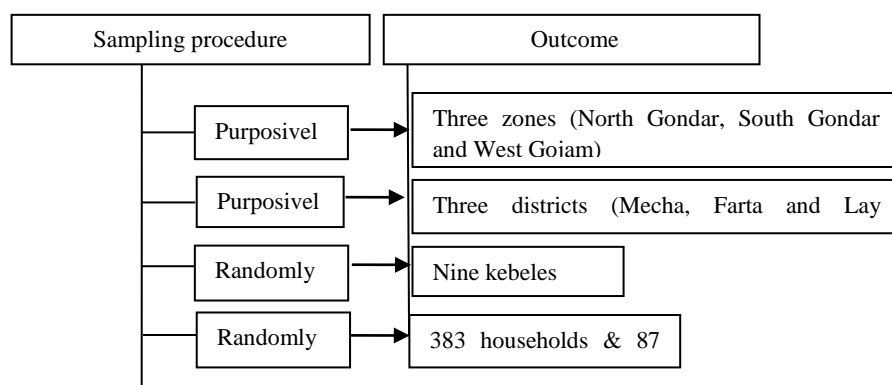

Figure 3: Sampling procedure

3.2.3. *Likert* scale

Farmers' opinions on the adequacy of the delivery of extension services on SWC practices were assessed using Likert-scale question items with 10 opinion statements. Farmers were presented with a series of

choices, including highly inadequate (1), inadequate (2), neutral (3), adequate (4), and highly adequate (5), for each item on the scale. If one had an extremely unfavourable opinion (1) towards each of the 10

statements. To show the frequencies and percentages of the adequacy of agricultural extension service types on SWC practices rendered by DAs, 'highly adequate' and 'adequate" 'were later combined into 'adequate' and treated as positive opinions. Conversely, 'highly inadequate' and 'inadequate' were combined into 'inadequate' and treated as negative opinions. 'Neutral' was left untouched. Undecided or neutral responses indicated that the farmers knew nothing or were not sure.

3.3. Data analysis

3.3.1. Descriptive statistics

Content analysis was used to transcribe the information collected from FGDs, KIIs, and observations using a notebook and tape recorder. The collected information was placed into categories (themes) based on the questions. The categories were then examined in detail for relevance, and those with similarities were merged. This process helped to reduce the volume of tape-recorded information, written text, and images. Quantitative data, on the other hand, were analysed using Statistical Package for Social Sciences (SPSS) computer software. Frequency tables, percentages, cross-tabulations, means, and standard deviations were calculated. Data were analyzsed based on the research objectives, as indicated below.

3.3.2. Econometrics model

The multiple linear regression model was used to account for (predict) the variance in the dependent variable, in this case, DA's Job Performance Index, based on linear combinations of the interval, dichotomous, or dummy independent variables. The multiple linear regression models was coded as the percentage of the job performance of the DAs against the set work output performance score in delivering extension services on SWC practices, where the percentage refers to the DA's job performance as evaluated by their immediate supervisors.

The independent variables that influence the DA's job performance in delivering extension services to farmers were related to the personal and socioeconomic attributes of the DAs. The multiple linear regression equation was as follows:

$$Y = \beta_0 + \beta_1 X_{(1)} + \beta_2 X_2 + \beta_3 X_{(3)} \ldots \beta_n X_{\_n} + \varepsilon \quad (3)$$

Where:
Y = Job performance of DAs in the delivery of extension services on SWC practices to farmers
β_0 = constant (intercept)
β = Regression coefficients
X = Explanatory variables
ε = error term

The underlying assumption of the model is that the DA's job performance in the delivery of extension services on SWC practices is determined by the DA's personal and socioeconomic characteristics.

Factors on receipt of extension services: The influence of farmers' personal and socioeconomic factors on their receipt of extension services on SWC practices was determined using a multiple linear regression model. The multiple linear regression model was used to account for (predict) the variance in the dependent variable, in this case, named extension service receipt index, based on linear combinations of the interval, dichotomous, or dummy independent variables. The multiple linear regression model was coded as the percentage of farmers who received extension services out of the 10 extension service types, where the percentage refers to the farmers who received extension services. The independent variables that influence farmers to receive extension services are related to the attributes of farmers and farms. The multiple linear regression equation used was as follows:

$$Y = \beta_0 + \beta_1 X_{(1)} + \llbracket \beta_2 X_2 + \beta_3 X_{(3)} \ldots \beta_n X_{\_} \rrbracket_{\_n} + \varepsilon \quad (4)$$

Where:
Y = receipt of extension services by the farmer
β_0 = constant (intercept)
β = Regression coefficients
X = Explanatory variables
ε = error term

The underlying assumption for the model is that the receipt of extension services on selected SWC practices is determined by farm and farmer attributes. In this model, the coefficient of multiple determinations (R^2) was used to assess the variance of the dependent variable from that of the independent variables.

3.3.3. Independent variables

The reason why a farmer has not applied key recommended SWC practices is influenced by various factors which are taken as independent variables. An independent variable is a variable that causes changes in the dependent variable. For this study, 19 independent variables were hypothesizsed to influence the dependent variable. Out of these variables, six were continuous and 13 were discrete. Independent variables included personal, socio-economic and institutional factors of farmers and Development Agents that may influence the dependent variable.

Age of the household head: It is measured on a continuous scale in terms of the household head's number of years of age at the time of data collection.

Sex of the household head: It refers to the biological differentiation of human beings. This is a dummy variable that takes a value of 1 if the household head is male and 0 otherwise.

Marital status: It indicates whether the household head is married, single, divorced, or widowed. It was measured in terms of the category of marriage, such as married (1), single (2), divorced (3), or widowed (4). However, with regard to Development Agents, they were neither divorced nor widowed, except they were either married or not married. Therefore, marital status for Development Agents was measured in terms of dummy variables of marriage, such as married (1) and not married (0).

Education level: It refers to the level of formal education of a farmer at the time of data collection. In the context of the Ethiopian education system, if the household head cannot read and write, he is enumerated as illiterate (no can't read and write). Household heads that are between 1 and 4 are considered as adult education; those who attended 5 - 8 are said to have a primary level of education and above 8, including university level, are considered as a secondary level of education. Education level is a discrete ordinal variable. The education level was measured in terms of categories of schooling, such as such as no read and write (1), adult education (2), primary education (3) and secondary education (4).

Household size: It is the total number of members in the household, including aged persons and children. It is measured on a continuous scale in terms of the number of members in the household at the time of data collection.

Household labour: It refers to the active labour force of the household who are between the ages of 15 and 65 and who can support in doing SWC practices. It is measured on a continuous scale in terms of the number of members in the household between the ages of 15 and 65.

Income: It is operationally defined as the value of the products of the household, including home consumption and income obtained from off-farm and non-farm activities that are expressed in birr (Ethiopian currency) or USD (United States Dollars) per year. It is measured on a continuous scale.

Landholding size: It refers to the area of the cultivated land owned by farmers or the household listed as a household member. Rented in farm land was included, but rented out was excluded in this measurement (Amhara National Regional State Commission of Plan (ANRS-CoP), 2015). It is measured on a continuous scale.

Cosmopolitanism: is the degree of orientation of the household heads towards outside the social system to which they belong to (familiar with or representative of many different countries and cultures, having an exciting and glamorous character associated with travel and a mixture of cultures).

Social participation: is the extent of affiliation of the household head with formal or informal association in terms of membership as well as the degree of involvement in the activities. It is a continuous variable.

Adherence to SWC By-laws: SWC By-laws are documents prepared by the watershed community that guide members of the watershed community by with the rules and regulations on SWC practices. The rules and regulations of SWC by-laws are developed by the members of the watershed community. SWC By-laws help the watershed community to get recognition by the government. Therefore, farmers may either implement SWC By-laws or not. This is a

dummy variable that takes a value of 1 if the farmer adheres to SWC By-laws and 0 otherwise.

Availability of FTCs: FTCs are staffed by Development Agents and are responsible for providing extension activities in rural areas. This is a dummy variable that takes a value of 1 if the farmer has an FTC available and 0 otherwise.

Access to NGOs extension services: NGOs are involved in supporting SWC practices in the areas of capacity building, particularly by providing training and experience sharing to farmers and Development Agents. This is a dummy variable that takes a value of 1 if the farmer has access to NGO extension services and 0 otherwise.

Involvement in training: The participants who receive extension training lead to have more information and understanding about the available SWC packages, so that they are most likely to develop a change in their knowledge, skills, attitude and behaviour. This is a dummy variable that takes a value of 1 if the farmer is involved in training and 0 otherwise.

Access to SWC hand tools: There is a variation across k Kebeles as well as farmers in the provision and distribution of SWC hand tools to the farmer. An I increase ment in the number of SWC hand tools develops the confidence of farmers to take action for the participation in SWC technology packages. This also leads farmers to be exposed to information which creates variations among themselves in getting access to knowledge. This is a dummy variable that takes a value of 1 if the farmer has access to SWC hand tools and 0 otherwise.

Involvement in extension planning: This is a dummy variable, which takes a value of 1 if the household head is involved in SWC extension planning and 0 otherwise. It is one of the extension tools that enable farmers to identify their SWC practice problems and to set sound solutions for further measures.

Involvement in extension monitoring and evaluation: This is a dummy variable, which takes a value of 1 if the household head is involved in SWC extension monitoring and evaluation and 0 otherwise. Similar to planning, it is one of the extension tools

that enable farmers to identify their SWC practice problems and to set sound solutions for further measures.

Contact with Development Agents: This is a discrete variable which refers to the frequency of contact that the household makes per month with the various information sources. The higher the linkage between farmers and Development Agents, the more the information flows and the SWC technological (knowledge) transfers between them.

Participating on-farm trial and demonstration: It is dummy variable having the value of 1, if the household head participated in the on-farm trial and demonstration and 0 otherwise.

4. Result and Discussion

4.1. Socio-economic characteristics of respondents

Table 2 shows that more than two-thirds (66.7%) of the DAs were in the younger age group (20-29 years old), with an average age of 28 years. The remaining DAs were > 29 years of age. This suggests that, in the study area, the DAs were mostly young. Regarding work experience, 62% of the DAs had worked for to 1-5 years. Similarly, 28.7% had worked for 6-10 years, whereas 9% had worked for more than 10 years. On average, the DAs had approximately 5 years of experience as Development Agents. This indicates that most of them served for a relatively short period. Oladele (2009) mentioned that more years of service would mean gaining more experience and delivering a cogent extension service.

Of all the DAs surveyed, 55% were married and 44.8% were single. This finding suggests that just over half of the DAs were married. In terms of sex distribution, 54% of the DAs were male, and 46% were female. This shows that there was a balanced representation of males and females among the DAs in the study area. This balance may have a positive impact on female farmers as it can help them access information about SWC practices.

According to the results, only 26.4% of the DAs have a degree in natural resource management. In contrast, 50.6% had a diploma, while 23% had a certificate in natural resource management. This suggests that the DAs were qualified for their jobs and were actively

learning on the job, which helped them perform their duties effectively. Approximately 94.3% of DAs received in-service training on SWC practices. However, 30% had undergone more than 10 days of training in the last 12 months. The results indicate that the majority of DAs received less in-service training. According to the key informant interviews, the training provided to DAs is not practical and does not align with the actual training needs of DAs.

The study asked DAs if they lived in the villages in which they worked. Nearly all DAs (96.6%) lived in job locations, while 3.4% lived outside the operational village areas. It is important for DAs to live where they work, as it helps them save time and build social relationships. Oladele (2009) remarked that for DAs to be effective, they must reside within their operational area so that they do not waste time walking. It was further noted that the Development Agent will become acquainted with the farming

community and its resources, will be more readily accepted by the farmers in his/her working area, and will always be readily available when required by the farmers.

The average monthly salary earned by the DAs was $ 117, with a minimum of $63 and a maximum of $163, with a standard deviation of $41. This is, however, not adequate, considering the present economic situation of the country. As long as any rise in the nominal wage—the monthly income that DAs receive—does not lead to inflation, the DAs should have received a satisfactory salary of $455 (ANRS-CoP, 2015). For instance, a raise in DA's pay shouldn't lead to a rise in the cost of various commodities like food, gasoline, diesel, goods, and services, which would have an adverse effect on the finances of other people with little purchasing power, dependents, and unemployed people.

Table 2: Development Agents' personal and socio-economic characteristics (n = 87)

Variables	Response	Freq.	%
Age (Years)	15 - 29	58	66.7
	30 - 49	29	33.3
	50 – 64	0	0.0
Working experience in years	1 - 5	54	62.1
	6 – 10	25	28.7
	11 – 15	4	4.6
	16 – 20	4	4.6
Marital status	Single	39	44.8
	Married	48	55.2
Sex	Female	40	46.0
	Male	47	54.0
Educational Qualification	Certificate	20	23.0
	Diploma	44	50.6
	Degree	23	26.4
Improving education level from a diploma to a degree (N = 44)	No	3	6.8
	Yes	41	93.2
Training attended (days/year)	0	5	5.7
	1 - 10	61	70.3
	11 - 20	7	8.0
	21 - 30	9	10.3
	31 - 40	5	5.7
Residence in the job location	No	3	3.4
	Yes	84	96.6
Monthly salary in USD	62.5	20	23.0
	87	19	22.0
	130.5	16	18.0
	163	32	37.0

Source: Own survey data

4.2. Farmers' opinions on the adequacy of SWC extension service

Based on famers' opinion, the first four extension service types on SWC practices: assistance to form the SWC farmers group; advising and teaching on the importance of integrated SWC measures; demonstration of survey tools for the layout of SWC practices; demonstration of the key recommendations on SWC measures were adequately delivered (mean = 3.16 to 4.2) by DAs (Table 3). This implies farmers have believed that DAs have been performing adequately for only approximately 40% of all types of extension services (i.e., four extension service types out of 10). However, the remaining six extension service types on SWC practices: technical support for banning free grazing; provision of training on SWC practices; assistance to involve farmers in SWC planning; assistance to involve the farmer in SWC monitoring and evaluation; helps to facilitate the access of SWC hand tools to farmers; advice and teaching on how to upgrade and maintain SWC structures were not adequately delivered by Das (which were below the average mean 3) delivered by DAs. This suggests that DAs did not perform adequately for 60% of all types of extension services (i.e., six out of 10 extension service types).

Focus group discussions (18 out of 21) and key informant interview participants (12 out of 14) stated that the system for monitoring and evaluation of SWC practices was important; however, DA's assistance to involve farmers in a continuous and participatory monitoring and evaluation system was not sufficient. In reality, the system for monitoring and evaluating SWC practices was, to some extent, continuous and participatory, but it was not sufficient because DAs did not provide sufficient support to farmers (ANRS-BoA, 2012).

The system for monitoring and evaluating SWC practices was found to be important for the delivery of extension services. However, the mean value was below the average, which implies that farmers' involvement in monitoring and evaluation was inadequate. The key informant interview of experts showed that the adequacy of DA assistance to involve farmers in SWC monitoring and evaluation was also determined by SWC practices based on the organizational arrangement of stakeholders.

An Integrated Food Security Project (IFSP) (2013) found that SWC practices based on the organizational arrangement of stakeholders contribute to the effectiveness of extension service delivery. However, stakeholders in the organizational arrangement did not interact actively, and DAs were not in a position to manipulate them because of their status in the hierarchy.

Table 3: Farmers' opinions on SWC extension service

Types of SWC extension services	n	Mean	SD	Adequate		Inadequate		Neutral	
				freq.	%	Freq.	%	freq.	%
Assistance to form the SWC farmers group was adequate	383	4.2	0.57	354	92.5	2	0.5	27	7.0
Advising and teaching on the importance of integrated SWC measures was adequate	383	4.18	0.58	352	91.9	3	0.8	28	7.3
Demonstration of survey tools for the layout of SWC practices was adequate	383	3.67	0.81	286	74.7	57	14.9	40	10.4
Demonstration of the key recommendations on SWC measures was adequate	383	3.16	0.98	222	58.0	161	42.0	-	-
Technical support for banning free grazing was adequate	383	2.74	0.07	155	40.5	228	59.5	-	-
The provision of training on SWC practices was adequate	383	2.74	0.07	155	40.5	228	59.5	-	-
Assistance to involve the farmer in SWC planning was adequate	383	2.6	0.09	137	35.8	246	64.2	-	-
Assistance to involve the farmer in SWC monitoring and evaluation was adequate	383	2.5	0.09	100	26.1	246	64.2	37	9.7
The extension helps to facilitate the access of SWC hand tools to farmers was adequate	383	2.2	0.98	68	17.8	288	75.2	27	7.0
Advice and teaching on how to upgrade and maintain SWC structures were adequate	383	1.2	0.98	8	2.1	348	90.9	27	7.0
Grand mean		2.92							

4.3. Job performance of the development agents

Table 4 shows the mean response ratings of the Development Agent job performance in the delivery of extension services on SWC practices. Development Agents were evaluated twice, by the head of the kebele office of agriculture and the supervisor of the SWC department, on the basis of Development Agents' performance in providing extension services on SWC practices to farmers. The average job performance scores given by the two evaluators were weighted.

The 14 normative extension functions were determined using a 5-point Likert-type rating scale of very poor (1), poor (2), average (3), good (4), and very good (5). A midpoint of 3 was established to make a decision; a mean score of less than 3 implied poor function, while a mean score greater than 3 implied good function. A mean score of 3 indicated an average or midpoint. Following these scores, the first five normative extension functions of the DAs (mean=3.485 to 3.93), which were above the average (mean=3) were well

performed well. This implies that DAs have been performing effectively for only 35.7% of all types of extension functions (five normative extension functions out of 14). The remaining nine normative extension functions of the DAs (mean=2.965-1.865), which were below the average (mean=3), were poorly performed. This suggests that the DAs did not perform effectively for 64.3% of all types of extension functions (nine normative extension functions out of 14).

Generally, the above results show that the DAs were not effective in providing extension services on SWC practices to farmers because the grand mean (2.93) was below the average (3). Study findings from KIIs revealed that 11 participants stated that supervisors of the SWC department were not adequately monitored or evaluated to ensure that extension services were adequately provided by the DAs.

Table 2: Job performance of development agents

Normative extension functions of the Development Agent	Rating of DAs		
	Supervisor of the SWC department	Head of the *kebele* office of agriculture	Average
Providing farmers with information on using different types of SWC technologies	3.92	3.94	3.93
Assisting farmers to be organized into SWC farmers' group	3.82	3.74	3.78
Advising and teaching farmers about the importance of integrated SWC measures	4.01	3.49	3.75
Making home and farm visits	4.07	2.93	3.5
Facilitating access of farmers to SWC hand tools	3.83	3.14	3.49
Using work time to contact farmers (Office calls)	3.43	2.5	2.97
Surveying for the layout of SWC practices	3.4	2.5	2.95
Measuring SWC key recommendations	2.91	2.93	2.92
Providing farmers with technical support for banning free grazing	2.52	2.46	2.49
Training farmers on SWC practices	2.48	2.48	2.48
Assisting farmers to involve in SWC planning	2.73	2.21	2.47
Assisting farmers to involve in SWC monitoring and evaluation	2.4	2.47	2.44
Helping farmers keep records	2.28	1.73	2.01
Advising and teaching farmers on how to upgrade and maintain SWC structures	1.69	2.04	1.87
Grand mean			2.93

4.4. Factors affecting the job performance of development agents

Table 5 shows the results of the multiple linear regression analysis showing the relationship between the level of job performance and the personal and socioeconomic characteristics of DAs. The coefficient of multiple determinations (R^2) was 0.713, which implies that approximately 71.3% of the variation in the level of job performance of DAs was accounted for by the joint action of the independent variables investigated, suggesting that the model has explanatory power on the changes in job performance in the delivery of extension services on SWC practices. Four out of the eight variables were significantly related to the level of job performance and these are sex, age, educational qualification and working experience.

Sex was negatively and significantly related to job performance at a 10 % level of significance. The explanation for this finding is that female DAs would perform delivery of extension services on SWC practices by 0.199 standard deviation units more than males. The probable reason could be those male DAs are much more occupied with various social and economic activities than female DAs. Moreover, female DAs might have had got the opportunity to have access to providing agricultural extension services. Age was negatively and significantly related to job performance at the 10% significance level. The explanation for this finding is that the older the DA, the lower his job performance, which implies that younger DAs performed better than older ones, did. For every standard deviation unit increase in age, the DA score on the extension service delivery of the SWC practices performance index decreases by 0.301 standard deviation units. This finding was in line with the finding that the average age of DAs was 28 years. This finding implies that the DAs were younger and in their economically active stage of life and that such a workforce could cope with the tedious and time-bound function of extension service delivery, as stated by Onu et al. (2013). This result is in line with the findings of Ironkwe (2009), who asserted that age usually has a direct influence on the level of performance; hence, most DAs were expected to perform maximally.

The level of education was positively and significantly related to the level of job performance of DAs at the

10% level of significance. This means that the educational level of DAs had higher scores in the delivery of extension services to SWC practices.

Table 5: Factors affecting job performances of DAs

Variables	Unstandardized Coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
Sex	-8.009	4.307	-0.199*	-1.859	0.067
Age	-1.131	0.607	-0.301*	-1.864	0.066
Income	0.001	0.004	0.075	0.360	0.719
Working experience	-2.493	0.684	-0.612***	-3.645	0.000
Marital status	5.489	5.972	0.147	0.919	0.361
Family size	0.373	3.083	0.023	0.121	0.904
Level of education	4.578	2.511	0.193*	1.823	0.072
Training	0.162	0.230	0.085	0.707	0.482
(Constant)	32.699	19.926		1.641	0.105
R = 0.802, R^2 = 0.713, Adj. R^2 = 0.706, F = 109.640 and P = 0.001					

The positive relationship indicates that those with higher educational qualifications performed better. In key informant interviews, SWC experts responded that job promotion encouraged DAs to upgrade their level of education from a Diploma to Degree. Promotion is a very important factor in job performance; hence, lower-qualified DAs may want to justify promotions they hope they get by upgrading their level of education.

Work experience showed a negative and significant relationship with job performance at the 1% level of significance. The negative sign implies that DAs who spent less time on the job, performed better than those who spent more time without upgrading or additional training. This means that for every standard deviation unit increase in working experience without upgrading or additional training, the Development Agent score on the extension service delivery of the SWC practice performance index decreases by 0.612 standard deviation units. In addition, during the KIIs, all SWC department supervisors stated that the majority of the old DAs were either not competent or were diploma holders. This does not conform to expectations. The multiple linear regression coefficients for marital status, family size, income, and extension training were not statistically significant.

4.5. Personal and socio-economic characteristics of the household heads

Age: The mean age of the household heads was 41 years, with maximum and minimum ages of 64 and 20, respectively. Table 6 shows that household heads were placed into three age categories (CSAE, 2015). Accordingly, more than half (57.4%) of the household heads were age category 30-49 (middle- age). About 20.1% of the household heads were in the age category of 15-29 (younger), and the remaining 22.5% of household heads were in the age category of 50-64 (older age).

Sex: The receipt of extension service delivery is determined by the different decisions and roles of male and female farmers in a given society. Table 6 shows a large percentage of male-headed households (88%) compared with female-headed households (12%). This implies that there are no equitable numbers of female-headed households in the study area. This may be explained by the patrilineal descendants of people in the study area.

Education: This is an important variable that increases farmers' ability to acquire, process, and use extension services in SWC practices. As shown in Table 5, half of the household heads (47.8%) had adult education, followed by primary education (32.1%), while the rest could not read and write (15.9%) or had secondary education (4.2%). There was a high literacy rate among farmers, and 84.1% were able to read and write. It is important to point out that the overall results emphasize the general picture that rural areas of Ethiopia are occupied by people with low education. Those who are educated up to secondary education rarely stay in rural areas. They normally migrate to urban centres to seek formal or clerical jobs in urban areas.

Family size: The average household size was 5.62 (SD=2.114), with the minimum and maximum being one and 12 members, respectively. This household size was higher larger than the Amhara Region's average household size (4.6) in 2015 (CSAE 2015). This large household size may be attributed to the tendency of adult sons or daughters (unmarried) to remain in the parental household. The study further noted that not all household members were capable of working on the farms. For this reason, the study compared the total number of household members and those capable of working on farms (active labour force between the ages of 15 and 64 years). The results show the differences between the two variables. The mean household size was 5.62 with 2.114 standard deviations, and that of household members working on farms was only 3.07 with 1.177 standard deviations. The difference represents the proportion of dependants, including older people, children, and the sick.

Land size: The average land owned was 1.11 hectares (ha) with a maximum and minimum of 3 and 0.25 ha, respectively, with a standard deviation of 0.484. The Amhara Region and the study area were placed under three landholding size categories (CSAE, 2015). Accordingly, it was noted that 57.4% of the households owned a small amount of between 0.25-1 ha of land. About 35.2% own medium -sized between 1.1-1.75 ha of land, and only 7.3% own large 1.76-3 ha of land. This implies that landholding size is generally very small. These findings are in line with national reports indicating low land ownership in rural areas (65%) in 2015 (CSAE, 2015). With uncontrolled population growth and land fragmentation, the landholding size of farmers is very small.

Income: Households were placed under three income categories based on information from the Central Statistical Authority of Ethiopia (CSAE, 2015). Based on this, Table 6 shows that 53.5% of farmers had low ($ 272-989) income, 37.6% have medium ($ 990-1706) income, and 8.9% had high ($ 1707-2422) income. This implies that the farmers' average annual income is generally very small ($ 1039) with a minimum and maximum of $ 272 and $ 2422, respectively, with a standard deviation of $ 451.#

4.6. Farmers' participation in social organizations
The relative social participation weight value varied based on the type of organisation and the household head's degree of involvement as membership or official status, in which the household head is a member, using the scale developed by Asres (2005) with slight modifications. The relative social participation weight value was calculated by involving experts to rate the relatively important type of household head membership and the degree of involvement in the activities. Accordingly, if the farmer is a member of the survey farmer for SWC practices, they would receive a score of relative social participation weight value of 40%; if the farmer is a member of the survey farmer (40%) and a member of the watershed development committee (20%) for SWC practices, they would receive a score of relative social participation weight value of 60% (i.e., 40% + 20%); if the farmer is a member of the survey farmer (40%), member of the watershed development committee (20%), development group leader (15%), one to five work team leaders (10%), members of the kebele (village) committee (10%), and members of local cultural associations (5%) for SWC practices, they would receive a score of relative social participation weight value of 100% (i.e. 40% + 20% + 15% + 10% + 10% + 5%).

As indicated in Table 7, for the type of institutions, household heads were involved in the majority of them were frequently involved in local cultural associations established for social security and economic issues (100%). Second, they were frequently involved as leaders of one to five work teams for SWC practices (25.9%), followed by membership in the kebele (village) committee (22.5%), and survey farmers for SWC practices (22.2%). The proportion of household heads involved in SWC practices as members of the watershed development committee was very low (8.1%).

Table 3: Personal and socio-economic characteristics of the households

Characteristic		Frequency	Percentage
Age of household head	15 - 29 years (Younger)	77	20.1
	30 - 49 years (Middle)	220	57.4
	50 - 64 years (Older)	86	22.5
Sex	Male	337	88.0
	Female	46	12.0
Marital status	Married	344	90.0
	Single	8	2.0
	Divorced	23	6.0
	Widowed	8	2.0
Level of Education	Unable to read and write	61	15.9
	Adult education	183	47.8
	Primary education	123	32.1
	Secondary education	16	4.2
Household size	Small size (1 - 3)	62	16.2
	Medium size (4 - 6)	188	49.1
	Large size (7 - 12)	133	34.7
	Average	5.62	
Landholding size in ha	0.25 - 1 (Small)	220	57.5
	1.1 - 1.75 (Medium)	135	35.2
	1.76 - 3 (Large)	28	7.3
	Mean = 1.11		
	Std.Dev. = 0.484		
	Minimum = 0.25		
	Maximum = 3		
Annual income category in USD	272 - 989 (Low)	205	53.5
	990 - 1706 (Medium)	144	37.6
	1707 - 2422 (High)	34	8.9
	Average = 1039		
	Std. Dev. = 451		
	Minimum = 272		
	Maximum = 2422		

Table 4: Farmers' participation in a social organization

Social organizations	Participants		Household heads relative social participation weight value in percent
	Frequency	Percent	
Member of local cultural associations	383	100	5
Leader of one to five work teams for SWC practices	99	25.9	10
Member of kebele (village) committee	86	22.5	10
Member of survey farmer for SWC practices	85	22.2	40
Development group leader for SWC practices	78	20.4	15
Member of Watershed development committee for SWC practices	31	8.1	20

Cosmopolitanism: This is measured in terms of the frequency of visits by the farmer outside his village about for information seeking for SWC purposes. Table 8 shows that 34.7% of farmers had low cosmopolitanism (rarely), 28.7% had medium cosmopolitanism (once a week), 20.1% had high cosmopolitanism (three or four days a week), and 16.5% had high cosmopolitanism (daily). Every household head in the study area visited a nearby own for one reason or another. Focus group discussions with farmers have shown that a greater number of farmers visited the nearby town for SWC practice-related issues and other reasons, such as shopping. Farmers met relatives and colleagues during their visits to nearby towns. They exchanged various types of information, including SWC practice-related information. They were able to buy the SWC hand tools and seedlings.

Table 5: Cosmopolitanism of the household heads (n = 383)

Frequency of exposure to external information of the household head	Frequency	Percentage
Rarely	133	34.7
Once a week	110	28.7
Often (three or four days a week)	77	20.1
Daily	63	16.5

4.7. Farmer's receipt of SWC extension services

The receipt of extension services was determined based on whether farmers received extension services on selected SWC practices. Farmers were expected to receive 10 types of extension services in SWC practices. Table 9 shows that 0.3% of the farmers received the lowest possible two, and 15.9% received the maximum of all 10 types of extension services. The maximum proportion of farmers (28.7%) received 80% of the available extension services.

The extension service receipt index was used as the dependent variable in this study. It reflects the percentage of farmers who receive extension services out of the 10 extension service types, where the percentage refers to the proportion of farmers who receive extension services. Therefore, the dependent variable is the weighted sum of the extension service receipt index. If the farmer had received six extension service types of the 10 extension service types, then he would receive 60%. The minimum and maximum numbers of extension services received by the farmers were two and ten. Therefore, the score ranges were between 20%-100% which was used as a valid measurement for the regression analysis. The higher the sum, the more extension services the farmer received, and vice versa.

The receipt of extension services depends on the interaction between the supply and demand of extension services and SWC practices.

Farmers may have no access to the supply, or they may not demand extension services, depending on their farm and personal attributes. On the supply side, access to extension services may be high or low depending on the preference of DAs to provide extension services to farmers where the possibility of implementing newly acquired knowledge is higher.

Farmers are less likely to demand extension services if they can learn and apply new technologies or knowledge by themselves, which we call the "knowledge effect". Furthermore, the possibility of looking for non-farm jobs may be higher for farmers, depending on their personal and socioeconomic characteristics. Therefore, on the one hand, there may be two forces affecting the demand for extension: the possibility of finding a non-farm wage job that is economically more convenient than the farmers' agriculture-related activity and the "knowledge effect." On the other hand, one force affects the supply of extension: the eagerness of DAs to provide services depending on farmers' personal and socioeconomic characteristics. The dynamics of these forces may explain the different levels of extension services received, depending on farmers' personal and socioeconomic characteristics.

Table 6: Extension service types received by the farmers (n = 383)

Number of extension service types received by the farmers		The proportion of farmers who received extension services	
Frequency	%	Frequency	%
2	20	1	0.3
3	30	9	2.4
4	40	12	3.1
5	50	40	10.4
6	60	59	15.4
7	70	54	14.1
8	80	110	28.7
9	90	37	9.7
10	100	61	15.9

4.8. Factors affecting farmer's' receipt of extension services on SWC practices

This study attempted to analyzse the attributes of farmers that affect farmers receiving extension services. In this case, the attributes of farms and farmers as independent variables and the extension service receipt index as a dependent variable were used as valid measurements for the regression analysis. Sex: In this study, the receipt of extension services was statistically significant and negatively related to sex at a 5% level of significance (Table 10). The explanation for this finding is that female farmers would receive extension services on SWC practices by 0.066 standard deviation units more than males. The probable reason could be that female farmers have no other means to go get out of poverty unless they rely on extension services, given that they have a fair opportunity to get information. Another reason could be that male farmers are much more occupied.

Age: The influence of farmer age on the receipt of extension services on SWC practices was statistically significant and positive. This means that for every standard deviation unit increase in age, the farmer's score on the receipt of extension services of the SWC practices index increases by 0.106 standard deviation units. The probable reason could be that young farmers have less household labour and are not encouraged to receive extension services. This was further explained by participants of the KIIs that the tendency of young farmers to deal with non-farm wages discouraged them from receiving extension services.

Landholding size*:* The relationship between landholding size in ha and receipt of extension services in percentage is significant and negative, meaning that for every standard deviation unit increase in landholding size, the farmer's score on the receipt of extension services of the SWC practices index decreases by 0.137 standard deviation units. This implies that the supply of extension services may be greater for smaller farms, since diseconomies of scale motivate DAs to favour small-scale farmers. Moreover, the demand for extension services may reduce as landholding size increases, given that wealthy farmers can afford more expensive and efficient alternatives to productive SWC technologies.

Cosmopolitanism: There was a significant and positive correlation between cosmopolitanism and the receipt of extension services on SWC practices (Table 10). Cosmopolitan farmers had higher scores on the receipt of extension services. This is associated with greater information exchange, which results in a greater receipt of extension services on SWC practices. This is consistent with the findings of Tsion et al. (2010) that the cosmopolitanism of farmers is positively and significantly related to the receipt of extension services.

Social participation: It is positively and significantly related to the receipt of extension services by farmers; that is, for every standard deviation unit increase in social participation, the farmer's score on the receipt of extension services of the SWC practices index increases by 0.716 standard deviation units. This implies that farmers who have positions in different informal and formal institutions are more likely to be aware of new information. More awareness of information improved farmers' knowledge, skills, and attitudes, which helped them, receive extension services. The variables sex and landholding size are not consistent with Roger's (2005) generalisations, which state that early adopters of innovations are male and owners of larger land sizes. However, in the current study, the recipients of extension services for SWC practices were females and smaller landowners. The other variables–household size, education level, and income–were not significant. Therefore, the nature of these variables is that farmers' receipt of extension services is not influenced by their education, income, or household size.

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Table 7: Factors affecting farmer's receipt of extension services on SWC practices

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	SE	Beta		
Sex	-0.365	0.148	-0.066[**]	-2.467	0.014
Age	0.018	0.005	0.106[***]	3.436	0.001
Household size	0.009	0.026	0.011	0.360	0.719
Education level	0.058	0.062	0.025	0.928	0.354
Landholding size	-0.534	0.114	-0.137[***]	-4.688	0.000
Cosmopolitanism	0.261	0.051	0.156[* **]	5.107	0.000
Social participation	0.051	0.002	0.716[* **]	22.774	0.000
Income	0.031	0.097	0.013	0.319	0.750
(Constant)	5.535	0.296		18.709	0.000

R = 0.863, R^2 = 0.745, Adj. R^2 = 0.741, F = 156.768 and P = 0.001

[**]Significant at the 0.05 level & [* *]Significant at the 0.01 level

5. Conclusion and Recommendation

Female DAs provide Extension Services much better than their male Counterparts if they are provided proper access to deliver Extension Services. There was a demonstrated greater performance of DA's that had less experience than those who had a longer period of experience without any additional training. The longer that the DA's were in the field and not continuing their education through on-going Training, Development, and Learning the less updated SWC knowledge and skills they had. A significant number of female farmers received the highest level of Extension Service via a balanced gender distribution of DA's (46% Female), which allowed for better emphasis on addressing the specific needs of women. There was a strong and negative correlation between the size of the land-holdings and the amount of Extension that was received; with smaller land-holdings having a larger amount of support; indicating that DAs might be favoring Small-Scale Farmers. As well, cosmopolitanism and social participation increase farmer access to extension services.

The Bureau of Agriculture's training programs must highlight the need to incorporate both technical and human-related skills (such as communication, mediation and conflict resolution, IT). Additional recommended actions include emphasizing female and economically active appointments; providing additional training; obtaining supervisor input; and developing succession plans. Extension services must remove the previously identified barriers to acquiring assistance for female farmers, such as inconvenient timing, distance required to travel, and unnecessary types of work-related responsibilities. An effective method of attracting farmers to become active participants in SWC-centered social initiatives is through increased social participation. Additionally, watershed development committees must be strengthened in terms of their number of members, their capability to carry out functions, and the amount of support they provide to sustain SWC practices; thus, providing the necessary continuity once project completion occurs. Collectively, these proposed options will help to enhance the effectiveness of extension services.

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