DETERMINANTS OF FARMER'S WILLINGNESS TO PARTICIPATE IN SOIL CONSERVATION PRACTICES IN CASE OF JELDU WOREDA,AMBO , OROMIA , ETHIOPIA

A Senior Research project Submitted to the Department of Agricultural Economics for the Partial Fulfillment of the Requirement for Bsc. Degree in Agricultural Economics

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ACRONYMS AND ABBREVIATIONS

CWR	Consumer-Worker Ratio
FAO:	Food and Agricultural Organization
SSA:	Sub-Saharan Africa
GDP:	Gross Domestic Product
HA:	Hectares
FFW:	Food for Work
SC:	Soil Conservation
SCP:	Soil Conservation Practice
VIF:	Variance Inflation Factor

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

APPENDIXES

ABSTRACT

This study in Jeldu Woreda, Ethiopia, analyzed factors influencing farmers' adoption of soil conservation practices using mixed methods and logistic regression on data from 90 households, finding that higher education levels (OR=11.63) and secure land tenure (OR=1.12) significantly increased participation, while greater farming experience (OR=0.28) and older age (marginally, OR=0.54) reduced engagement, suggesting generational and innovation-adoption divides. Institutional weaknesses were evident, with limited access to extension services (38%), credit (45%), and conservation information (58%), despite 57% participation rates and widespread reports of severe soil erosion (60%). Contrasting with regional studies, the findings emphasize context-specific drivers, prompting recommendations for land certification, adult literacy programs, and youth-focused extension services, though small sample size and model instability warrant caution. The research highlights actionable pathways for sustainable land management in high-degradation settings while calling for deeper exploration of tenure-gender-resource interactions to refine conservation strategies.

1. INTRODUCTION

1.1 Background

Soil degradation was a significant issue internationally. Even worldwide, it became a main factor for the reduction in agricultural production. Environmental specialists took many measures to reduce its effects. In Africa, similar efforts occurred.

The IFPRI report stated that sustainable management of natural resources such as land, water, and forests was essential for strengthening agricultural systems in developing countries (IFPRI, 2022). Poor management of these resources led to land degradation, water scarcity, and deforestation.

According to a 2021 UNEP report, environmental degradation remained a major threat to food security in Africa. Unsustainable land use and climate change drove land degradation, undermining agricultural productivity (UNEP, 2021).

Ethiopia faced severe deforestation, with forest cover declining from 34% in the 1900s to 15.5% by 2020 (EFCCC, 2022). In Jeldu District, soil erosion resulted from improper soil management, high rainfall, and population density

.Land degradation is a major cause of poverty in rural area of developing countries. In many areas, farming population has experience decline in real income due to demographic, economic, social and environmental changes. Land degradation is result of several factors of both physical and socioeconomic nature. During the past decade, Ethiopia has face serious ecological imbalance mainly due to a large-scale deforestation, uncontrolled grazing practices, soil erosion cause by improper farming practices and destructive forests exploitation and wildfire. The consequence of which have been a declining agricultural production, water depletion, disturber hydro-logical behavior in the river basins, and food insecurity (Daniel, 2013).

Anemut (2012), argues that soil are important natural resources as they have useful effects on ecological balances and also for they are the means for the livelihood of many local people worldwide; especially in the developing countries. However, due to lack of efficient property right, increase population

growth, lower productivity of agriculture and fast expansion of farmlands in most developing countries many environmentally important areas are highly degrade. The severity of soil erosion in jeldu district is generally the result of improper soil management, high rainfall and population density and low vegetation cover. In many areas of the kebele soil erosion is the wide spread problems that damage the cultivate lands of the farmers. The conservation measures are implement in a farm participatory approach. Efforts to install conservation measures on erodible lands will initiate following the 1975 land reform and establishment of peasants associations, which were instrumental in mobilizing labor and assignment of local responsibilities. In order to combat soil degradation and to introduce sustainable use of resources, there is a need to take action.

At present, jeldu district area is facing extreme soil degradation. The principal factors responsible for the problem include low soil conservation practices and exposure of its topography especially to water fluid, inherent erodible nature of the soils and expansion of farmland.1.2 Statement of the Problem

Environmental degradation in Ethiopia was synonymous with land degradation (Almena, 2018). Soil conservation measures were introduced in the Oromia region through campaign work, but peasants dismantled structures when coercive pressure ended.Jeldu District faced extreme degradation due to steep topography, erodible soils, and inadequate conservation practices. Farmers' perceptions of their environment were often misunderstood, and conservation projects lacked local participation (Bekele and Holden, 2018)

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often misunderstood, and conservation projects lacked local participation (Bekele and Holden, 2018)

1.3 Objectives of the study

General Objectives

- To identify determinants of farmers' willingness to participate in soil Conservation

Specific Objectives

- ★ To identify determinant of soil conservation participation in
- ★ To identify attitudes of farmers towards soil conservation practice

Research questions

I. What are the factors affecting the willingness of farmers to participate in soil conservation practices in areas of jeldu woreda?

II. What is attitude of farmer's towards soil conservation look like

1.4 Significance of the Study

Identification of factors that influence farmers' willingness to participate in long-term conservation practices can help policy makers, Non Governmental Organizations (NGOs), international organizations, etc. to take appropriate action in formulating projects/plans that curb the problem of land degradation with active participation of farmers.

This study is aimed to provide first hand information on farmers' perception of soil degradation problem, their willingness to participate in conservation practices, the factors affecting their participation and the relative importance of the factors on farmers' willingness to participate in soil conservation practices. In addition, the study was expected to provide policy makers with first hand information that could be used to formulate projects with active participation of the end-users from inception up to implementation stages.

1.5 Scope and Limitations of the Study

The study aims at identifying factors that determine farmers' willingness to participate in soil conservation practices and the relative importance of these factors as well as assessing the problems of soil erosion. This study was limited to one kebele of the Oromia Regional State, in Western shawa Zone, jeldu woreda. This is mainly because of limited availability of resources; transportation cost problems to

undertake the study at a wider scale. For the same reason, the sample size is limited to few respondents. Although the study is limited both in sample size and area coverage, the results of the study are expected to be of value in designing appropriate conservation polices.

2. LITERATURE REVIEW

2.1 theoretical review

2.1.1 concept and definition

The concept of "Farmers' Willingness to Participate in Soil Conservation Practices" referred to the readiness and motivation of farmers to adopt and implement various soil conservation measures on their agricultural land. According to a 2020 study published in the journal Land Use Policy:

"Farmers' willingness to participate in soil conservation practices was a key determinant of the success and sustainability of such efforts. It reflected the farmers' attitudes, perceptions, and behavioral intentions towards engaging in practices that could help prevent or mitigate soil degradation, erosion, and related environmental issues on their farms" (Asfaw et al., 2020).The definition and key aspects of this concept, as outlined in the literature, included:Awareness and knowledge: Farmers' level of understanding about the importance of soil conservation and the available practices.Perceived benefits and costs: Farmers' assessment of the potential economic, environmental, and social benefits versus the costs and labor requirements of adopting soil conservation measures.

Land tenure security: Farmers' confidence in their long-term rights and control over the land, which influenced their willingness to invest in conservation.Access to resources and support: Availability of financial resources, technical assistance, and institutional support to enable farmers to implement soil conservation practices.

Social and cultural factors: Influence of peer networks, cultural norms, and local institutions on farmers' decision-making around soil conservation.Understanding and enhancing farmers' willingness to participate was crucial for the design and implementation of successful soil conservation programs and policies, particularly in developing countries like Ethiopia where land degradation was a major challenge.

2.1.2 conservation and rehabilitation

A community confronted two basic situations with respect to soil or natural resources. Either soil or natural resources were not degraded, because they were not overexploited, or else the landscape and soil were degraded (i.e., partially or totally

destroyed) and this destruction was progressive. Each situation required a different type of action (FAO, 2013). Soil conservation was a means of preserving natural resources for potential agricultural production and was essential for the survival of certain groups of people given demographic and social trends. Rehabilitation, on the other hand, was defined as restoring the productive potential of degraded natural resources to their original level or one approaching it: in other words, corrective action.

2.1.3 Theoretical Approaches to Land Degradation

The diagnoses of the solution to the land degradation problem varied greatly across disciplines and among stakeholders. The literature reported at least three main approaches or policy paradigms towards dealing with the difficulties of land degradation in developing countries (Biota et al., 2011).

2.1.4 The Classic Approach

The classic approach assumed that technical solutions to land degradation were available and that the problem was implementation-related. The emphasis of this approach had been on technical fixes and expert opinions, and little merit had been attached to local land users' practices and participation (Clay and Schaffer, 1984). It identified mismanagement of land by users—who were ignorant, irrational, and traditional—and their subsistence fundamentalism as the core problem in soil and water conservation practice. Many soil and water conservation projects in developing countries failed to take into account the factors determining resource users' land management decisions and collapsed shortly after special incentives and subsidies were no longer available.

2.1.5 The Populist Approach

The second paradigm, often referred to as populist, linked poverty and environmental degradation. It emphasized the participation of local people by using their knowledge and practices as a guide for policy and action (Chambers, 1983). According to this approach, failures in soil and water conservation measures were of a technical nature: inadequate or misapplied research; lack of fit between techniques and local farming

systems and livelihood strategies; and lack of participation by land-users in designing and implementing resource conservation practices.

2.1.6 The Neoliberal Approach

The third approach, often called neoliberal, drew from both the classic and populist approaches. From the classic approach, it took the idea that technology to control land degradation existed, and from the populist approach, it borrowed the notion of empowerment of the people. It argued that the major degradation causes were institutional failures and the lack of adequate incentives for the adoption of appropriate conservation technologies among land resource users (World Bank, 2012).

2.1.7 On-site and Off-site Costs of Soil Degradation

The negative consequences of soil degradation were widely recognized, but until recently, few attempts had been made to estimate the magnitude of the costs involved. Economic losses arising from soil degradation could be divided into on-site and off-site costs. On-site costs referred to the direct effects of soil degradation on the quality of the land resource itself, often expressed in terms of reduced agricultural productivity. Off-site costs referred to the indirect effects of soil degradation, and usually took the form of externalities. Most off-site costs could be traced to the effect of silt and soil nutrients washing into surface water or leaching into subterranean aquifers by rainfall and irrigation or runoff (Bishop, 1992).

2.2 Empirical Literature Review

Studies on the determinants of soil conservation decision behavior of farmers in Ethiopia had been limited. Generally, the past approach to soil conservation studies emphasized technical solutions to soil erosion problems to the neglect of socioeconomic constraints (Shiferaw and Holden, 2013).

For decades, it was believed that technological innovations combined with scientific methods were the answers to soil erosion problems. This led to the realization that soil conservation was not only a technical problem but also a socioeconomic problem, which directed attention to socioeconomic and behavioral factors influencing soil

conservation decision-making. This was evident from the ever-increasing literature on this area (Wegayehu, 2015).

The proximate causes of land degradation were the symptoms of inappropriate land management practices as conditioned by the underlying factors. Hence, efforts for soil conservation needed to address the underlying causes primarily, as focusing on the proximate causes would have meant addressing the symptoms of the problem rather than the real causes (Gebremedhin, 2010).

Berhane and Swinton (2009), using a double-hurdle model, identified causal factors for soil conservation adoption versus intensity of use. Farmers' reasons for adopting soil conservation measures varied sharply between stone terraces and soil bunds.

According to Baidu-Forson (2015), factors that motivated the level and intensity of use of specific soil management technologies included: a higher percentage of degraded farmland, extension education, lower risk aversion, and the availability of short-term benefits. This result showed that technologies should have been targeted to locations that had large percentages of degraded farmland and that there was a need to provide extension education that demonstrated the risk-reduction capacities of conservation techniques.

A case study by Lapa and Pandey (2015) on the adoption of contour hedgerows as a soil conservation practice in Philippine uplands found that age of the farmers, level of education, land ownership, access to markets, membership in a local organization of farmers with labor exchange arrangements among members, and slopes were the significant factors affecting the use of conservation.

Sridharan et al. (2015) reported that factors such as orientation to farming, education, cost-sharing, or government assistance affected the decision behavior of farmers on soil conservation practices significantly. Moreover, they showed that farm size, tenure arrangement, and reduction in land intensity, measured by land-to-man ratio, affected farmers' decisions on soil conservation practices.

Sambrook (2009) stated that there would have seemed to be only limited possibility for the successful transfer of modern land-use technologies from other tropical

regions to sub-Saharan Africa. The author underlined that the real challenge was to keep the rural population settled on the land, allowing them to lead a decent life from consumption and sale of the produce of the land under their care on a sustainable basis, with fair and stable prices, no trade barriers, no competition from subsidized food imports, assured supply of inputs, and effective means to transmit innovations to and from farmers nationally and regionally.

Most empirical studies on land degradation analyzed the impact of physical factors like topography, climate, and soil, farming practices, and population pressure on soil erosion (Bekele and Holden, 2014). This study suggested interesting causal relationships that shed light on the impact of population pressure on resource degradation. With an increase in population pressure, intensification of cropland became more common (Grupperud, 2013).

According to Lynne (2014), factors such as income and the nature of terrain were found to affect conservation behavior. Farmers' attitudes influenced the amount of effort exerted in conservation. The author stressed that investment in specific technologies would have been enhanced by the dissemination of knowledge and demonstration of the level of gains from the technologies and their potential risk-reduction characteristics. Even though relatively few conservation projects had been evaluated in Ethiopia, available evidence indicated that extensive conservation works had been initiated since 1945 when the Forestry and Wildlife Division of the Ministry of Agriculture attempted, through legal actions, to protect forest areas (Campbell, 2010). Conservation works accelerated rapidly following the 1975 Ethiopian revolution, largely due to the creation of peasant associations and the nationalization of rural land under the nominal control of the peasants' associations.

A recent study by Bekele and Holden (2014) in North Shewa Zone identified that farmers' perceptions of soil erosion problems were determined by factors related to the erosive potential of the area, access to information, perceptions of technology attributes, and the intensity and type of land use. Physical erosion potential (slope) was the most important determinant of the perception of soil erosion. The higher the slope, the higher the probability that the recognition of soil erosion would have been above any fixed level. Access to information through extension and other

channels was found to be positively correlated with the recognition of soil erosion problems.

A study by Tegegne (2010) on willingness to pay for environmental protection in Jeldu District (western Ethiopia) suggested that efforts to make people participate and become involved in environmental protection should have focused on their labor instead of their financial contribution. The author underlined that if financial contribution was required, projects might have targeted “wealthy” farmers instead of poor ones. To convince people to contribute labor during peak seasons, education could have been considered. During slack seasons, large-sized households and younger people were more likely to spend time on environmental protection.

2.7 Conceptual Framework

Dependent Variable: Farmers' participation in soil conservation practices (binary outcome: participant/non-participant)

.Independent Variables: Farm income (X1) ,Age of the household (X2) Family size (X3) Sex of the household (X4)Farming experience (X5),Access to information (X6),Access to credit (X7),Land tenure (X8),Perception of soil degradation (X9),Perception of benefits (X10),Education level of the household (X11),

Conceptual Relationships:Socio-economic Factors:Farm income, age, family size, sex, farming experience, and education level were expected to influence the farmers' willingness and ability to participate in soil conservation practices.Institutional Factors:Access to information, access to credit, and land tenure represented the enabling environment and resources available to farmers, which could affect their participation.Perceptual Factors:Perception of soil degradation and perception of benefits shaped the farmers' motivation and willingness to engage in soil conservation.

The conceptual framework suggested that the independent variables (socio-economic, institutional, and perceptual factors) would collectively determine the farmers' participation in soil conservation practices (the dependent variable).The sampling method using the Yemane formula and the proposed logit model analysis were appropriate choices to investigate this conceptual framework. The logit model was suitable for the binary dependent variable (participation/non-participation)

and could help identify the significant determinants of farmers' willingness to participate in soil conservation practices.

This conceptual framework provided a structured approach to guide the data collection, analysis, and interpretation of the study findings, ultimately contributing to a better understanding of the key factors influencing farmers' engagement in sustainable soil management.

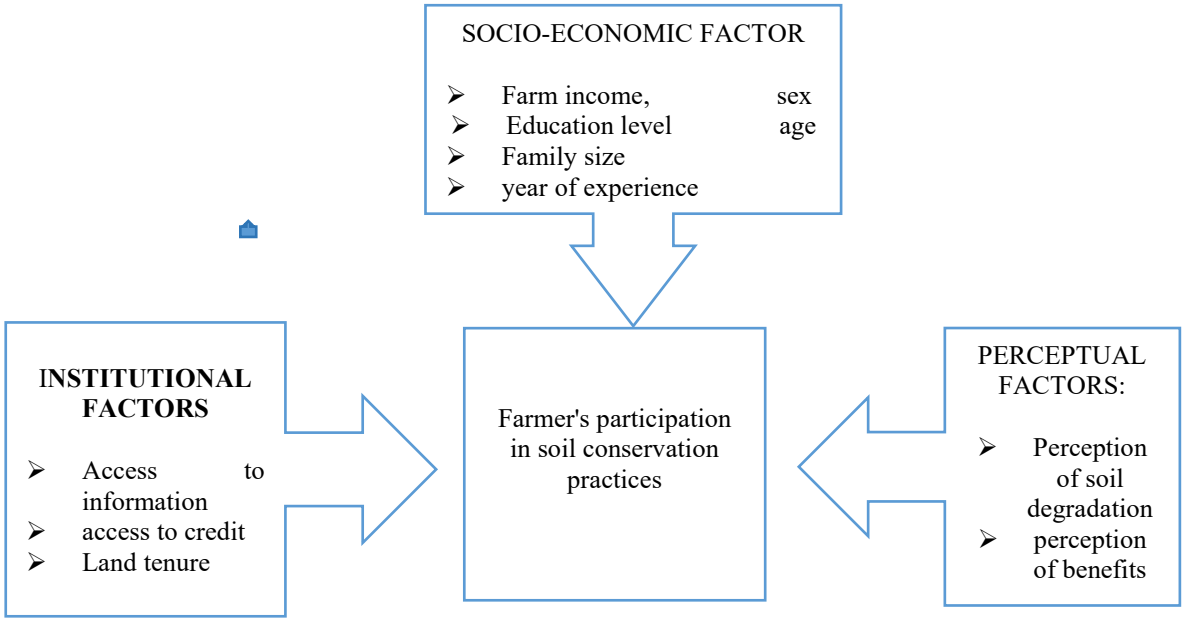

Figure 1 Frame work of study

3. METHODOLOGY

3.1 Description Of The Study Area

The study was undertaken in Jeldu Woreda, which was located in the West Shewa Zone administration of Ambo Town, Oromia Regional State. Jeldu Woreda was situated approximately 72 km east of Ambo Town and 127 km from Addis Ababa.

Jeldu was one of the districts in the Oromia region of Ethiopia. Part of the West Shewa Zone, Jeldu was bordered on the south by Dendi, on the southwest by Ilfeta, on the north by Ginde Beret, on the northeast by Meta Robi, and on the southeast by Ejerie. Towns in Jeldu included Gojo, Osole, and Shekute, Boni.

The 2007 national census reported a total population for this woreda of 202,716, of whom 99,896 were men and 102,820 were women; 14,384 or 7.1% of its population were urban dwellers. The study area was categorized under the Waynedega agricultural climatic zone and had an elevation ranging from 880 to 2,400 meters above sea level.Geographical Coordinates:

Latitude: 9° 1' 0" N

Longitude: 37° 40' 0" E

The rainfall in the area averaged around 900 mm, with the dominant rainfall period lasting from June to September. The maximum and minimum temperatures ranged from 17°C to 22°C, respectively. The area had two types of soil: red and black. The total land coverage was approximately 1,037 hectares, of which 120 hectares were grazing land, 35 hectares were forest, 124 hectares were irrigation land, and the remaining 758 hectares were cultivated land, shrubland, and farmland (kebele administration).

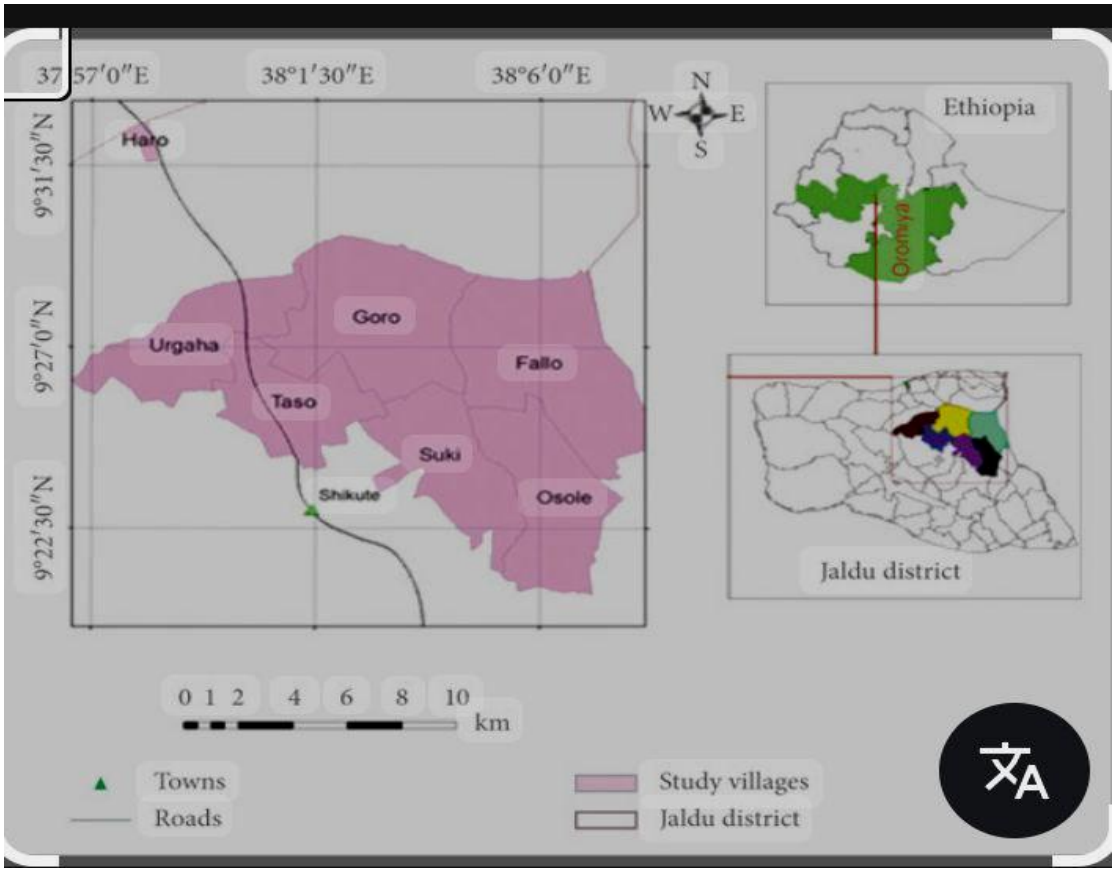

Figure 2 Map of study area

The major economic activity of the area was a mixed farming system, primarily crop production and livestock rearing. The most commonly cultivated annual crops included wheat, teff, maize, and potatoes. Annual crops were cultivated through subsistence farming. Dange was selected as the study site due to its accessibility, availability of information, and proximity to the campus.

3.2 Type And Source Of Data

Different types of data sources (qualitative and quantitative data) were collected, and the data relevant to the study's objectives were gathered from various sources. The study relied on both primary and secondary data sources. Primary data were collected from a sample of respondents and key informants. Secondary data were obtained from experts (natural resource experts), books, statistical reports, and official documents.

3.3 Sampling Size Determination And Sampling Technique

In the study area of whom were men and were women; . The sample size was determined using Yemane's sam, there were specifically 900 households, pling formula at a 90% confidence level.

Yemane's Formula: $n = \frac{N}{1+N(e)2}$

Where: n = samn$= \frac{900}{1+900(0.1)2}$ =90

ple size N = total number of households (900) e = margin of error (0.1)Substituting the values:

$n_i = \frac{n+Ni}{N}$

Group	N	n
Kilbe	500	50
Karsa	400	40
Total	900	90

Due to time, financial, and logistical constraints, a sample of 90 individual household heads was surveyed using a random sampling technique. A simple random sampling technique was selected due to population homogeneity.

3.4 Method Of Data Collection

Data for this study were collected in July from farm household farmers using structured interviews. The primary data were supplemented by secondary data collected from relevant sources. The survey aimed to gather data and information on

various aspects of land degradation, including perceptions of the degradation problem, its severity, and farmers' willingness to participate in conservation practices.

3.5 Method Of Data Analysis

3.5.1 Descriptive Model

The quantitative data analysis involved the calculation of frequencies, percentages, ratios, means, and standard deviations to analyze the collected data. For central tendency, mean, median, and mode were used. For measures of dispersion, standard deviation, variance, and range were applied. At the end, a Chi-square test was used to test the association between variables such as age, education, and farm size.

3.5.2 econometric model

At the multivariate analysis stage, since the dependent variable was dichotomous, a binary logistic regression model was fitted. Logistic regression was applied to examine the relationship between farmers' participation and a set of predictor variables.

Logit Model:

$$\log_{f0}(p1-p)=\beta0+\beta1X1+\beta2X2+\beta3X3+\beta4X4+\beta5X5+\beta6X6+\beta7X7+\beta8X8+\beta9X9+\beta10X10\log(1-pp)=\beta0+\beta1X1+\beta2X2+\beta3X3+\beta4X4+\beta5X5+\beta6X6+\beta7X7+\beta8X8+\beta9X9+\beta10X10$$

Where:pp = probability of participation (coded as 1),1−p1−p = probability of non-participation (coded as 0)

β0β0 = intercept termβ1,β2,...,β10β1 ,β2 ,...,β10 = regression coefficients for independent variables

Independent Variables: X1; Farm income X2 Age of the household , X3 : Family size X4;Sex of the household, X5 : Farming experience, X6 : Access to informatio, X7 : Access to credit, X8 : Land tenure, X9 : Perception of soil degradation, X10 : Perception of benefits, X11 : Education level of the household

3.6 THE DEPENDENT VARIABLE OF THE MODEL

The dependent variable was a dichotomous characteristic measuring the willingness of a farmer to participate in soil conservation practices by contributing labor. It was represented in the model as 1 for a willing farmer and 0 for a non-willing farmer.

3.7 The Independent Variables Of The Model

The following variables were hypothesized to determine farmers' willingness to participate in soil conservation practices, based on findings from past studies:

Education level of the household (edu):A dummy variable (1 = literate, 0 = illiterate). Education was assumed to increase farmers' ability to process and use information.

Age of the household (Age): The effect of age was hypothesized to be negative, as younger farmers were expected to have longer planning horizons and greater openness to innovation.

Family size (f sz): Larger families were hypothesized to have more labor resources for conservation activities.Sex of the household head (SEX):A dummy variable (1 = male, 0 = female). Gender was included to explore differences in environmental valuation.

Farming experience (exper): The number of years the farmer had been engaged in agriculture.Access to information (info):The farmer's ability to access conservation-related information through extension services or media.

Access to credit (cedit): The farmer's ability to obtain loans or subsidies for conservation investments.Land tenure (tenu):Security of land rights (1 = secure, 0 = insecure).Perception of soil degradation (degr):The farmer's assessment of soil degradation severity (1 = severe, 0 = not severe).

Perception of benefits (benf):The farmer's belief in the benefits of conservation (1 = beneficial, 0 = not beneficial).Farm income (inco):Level of income from agricultural activities.

Variable code	Variable definition	Measerument	Expected sign
dependent			
Farpn	Farmer Paticipation		
Independent			
edu	Education level of the household		Positive
age	Age of the household	Year	Negative
f sz	Family size	number	positive
sex	Sex of the household head		Positive
exper	Farming experience	Year	Positive
info	Access to information		Positive
cedit	Access to credit		positive
tenu	Land tenure	Hectare	Negative
degr	Perception of soil degradation		positive
benf	Perception of benefits		Positive
inco	Farm income	birr	Positive

Figure 3 expected sign of variable

4 RESULTS AND DISCUSSION

This chapter deals with the analysis of the survey data and interpretation of the analytical findings. As already noted, a structured interview was administered to 90 sample households heads in jeldu Area with the main aim of investigating determinants of farmers' willingness to participate in soil conservation activities. The interview was designed in such a way that it enables to collect data on personal and socioeconomic characteristics of farm households as well as on farmers' willingness to participate in soil conservation practices.

It was stated above that farmer's willingness to participate in soil conservation to be influenced by many factors. ten factors have been regressed and their regression results are presented below in econometric analyzing part. It is shown at below that 4 explanatory variables are significant with having p-value < 0.05. These are Age, .Land Tenure ,Education Level ,Years of Farming Experience:

4.1 Descriptive Results and Analysis

1. Demographic Factors

Variables: Age, Gender, Marital Status, Education Level, Family Size.

Table 1 Demographic Factors

Variable	Category/Description	Frequency	Percentage	Mean	Std. Dev
Age	age of farmers (years)	90	-	45.2	12.3
Gender	Male-headed households	61	68%	-	-
	Female-headed households	29	32%	-	-
Marital Status	Married	67	74%	-	-
	Non-Married (Single/Divorced/Widowed)	23	26%	-	-
Education Level	Illiterate	29	32%	-	-
	Literate (read/write)	41	45%	-	-
	Completed High School	21	23%	-	-
Family Size	Average household size	90	-	5	2.4

Course: own survey 2024

Descriptions of Variable

Age represents farmers' age in years as a continuous variable, with a mean of 45.2 years and a standard deviation of 12.3, indicating moderate variability. The sample captures a wide age range, suggesting older farmers likely bring more farming experience, though age may also influence adoption rates of new conservation practices.

Gender is coded as a binary variable (Male = 1, Female = 0), with 68% (n = 61) of households headed by males and 32% (n = 29) by females. This imbalance highlights potential gender disparities in decision-making roles or access to resources for soil conservation.

Marital Status is a categorical variable where 74% (n = 67) of farmers are married, while 26% (n = 23) are single, divorced, or widowed. The high proportion of married farmers may reflect greater household labor availability, which could facilitate participation in labor-intensive conservation activities.

Education Level categorizes farmers as illiterate (32%, n = 29), literate (45%, n = 41), or high school-educated (23%, n = 21). The prevalence of illiteracy underscores challenges in disseminating written conservation guidelines, necessitating alternative communication strategies.

Family Size a continuous variable, averages 5.1 members per household (SD = 2.4). Larger families may benefit from more labor for conservation work but could also face higher dependency ratios, straining resources for long-term investments.

2. Socio-Economic Factors

Variables: Farm Income, Access to Credit, Years of Farming Experience, Types of Products, Fertilizer Use.

Table 2 Decribtion of Socio-Economic Factors

Variable	Description	Frequency (n=90)	Percentage/Mean	Std. Dev
Farm Income (Crop)	% relying on crops as primary income	59	65%	-
Access to Credit	% with access to credit	41	45%	-
Farming Experience	Average years of farming	90	18.7 years	9.8
Chemical Fertilizer Use	% using chemical fertilizers	50	55%	-

Course: own survey 2024

Farm Income (Crop) reflects that **65% of farmers (n = 59)** depend primarily on crop production, emphasizing the critical need for soil conservation to safeguard their livelihoods.

Access to Credit is limited, with only **45% (n = 41)** of farmers having formal financial access, indicating potential barriers to funding conservation efforts.

Farming Experience averages **18.7 years (SD = 9.8)**, demonstrating substantial familiarity with local agricultural conditions, which could enhance adoption of context-specific conservation practices.

Chemical Fertilizer Use is reported by **55% (n = 50)** of farmers, suggesting a reliance on synthetic inputs that may necessitate balancing productivity with sustainable soil management strategies.

Perceptual Factors

Table 3 Perceptual Factors

Variable	Description in %	Frequency (n=90)	Percentage	Std. Dev
Perceive Soil Degradation	acknowledging soil degradation	65	72%	-
Perception of Benefits	believing conservation is beneficial	57	63%	-
Access to Information	Aware of conservation practices	52	58%	-

Course: own survey 2024

Perceive Soil Degradation is acknowledged by **72% of farmers (n = 65)**, in area widespread recognition of soil quality decline as a pressing issue. **Perception of Benefits** reveals that **63% (n = 57)** view conservation practices as advantageous, though **42% (n = 38)** lack sufficient information, underscoring gaps in outreach efforts.

Access to Information on conservation methods is reported by **58% (n = 52)**, that nearly half of farmers may face challenges in accessing actionable guidance, which could hinder effective implementation of soil conservation strategies.

Institutional Factors

Table 4 Institutional Factors

Variable	Description in %	Frequency (n=90)	Percentage/Mean	Std. Dev
Extension Services	receiving extension support	34	38%	-
Frequency of Visits	Average visits by development workers	90	2.1 visits	1.5
Land Tenure	with secure land rights	47	52%	-

Course: own survey 2024

Extension Services are accessed by only 38% of farmers (n = 34), indicating limited institutional support for disseminating conservation knowledge. Frequency of Visits by development workers averages 2.1 times per year (SD = 1.5), with variability suggesting inconsistent engagement across households. Land Tenure security is reported by 52% (n = 47) of farmers, a critical factor for incentivizing long-term investments in soil conservation, as secure rights reduce fears of losing land improvements

Table 5 Environmental Factors

Variable	Description in %	Frequency (n=90)	Percentage	Std. Dev
Livestock Ownership	owning livestock	63	70%	-
Manure Use	using manure	42	47%	-
Soil Erosion History	experiencing severe erosion	55	61%	-
Conservation Participation	participating in practices	51	57%	-

Course: own survey 2024

Livestock Ownership is reported by **70% of farmers (n = 63)**,a strong reliance on livestock for livelihoods. However, only **47% (n = 42)** utilize manure for soil enrichment, indicating underuse of organic fertilizers despite its availability. **Soil Erosion History** affects **61% (n = 55)** of farmers, with severe erosion cited as a critical challenge threatening agricultural productivity. Despite these challenges, **Conservation Participation** is reported by **57% (n = 51)** of farmers, demonstrating proactive efforts to mitigate land degradation through structured practices.

4.2.Econometric Analysis of Factors Affecting Farmers' Willingness to Participate In jeldu

As discussed earlier, the logit model was used to analyze determinants of farmers' willingness to participate in soil conservation practices. The farm household is either willing or not willing to participate in soil conservation practices. Consequently, the variable willingness to participate in soil conservation practices by contributing labor was used as a binary dependent variable taking a value 1 indicating the willingness of the farmer to contribute labor Summary of explanatory variables included in the logistic regression model is given below.

4.3 Discussion on Significant Explanatory Variables

The logistic regression model shows that out of the ten variables hypothesized to determine willingness of farmers' to participate in soil conservation practices, 4 were statistically significant at less than 10% probability level. More specifically, the coefficients of age,Land Tenure ,Education Level were significant. Out of the ten explanatory variables hypothesized to explain the willingness of farmers' to participate in soil conservation practices in the study area, 4 were found to be significant at less than 0.05p-value.

The coefficients of six variables were not statistically significant at the conventional probability levels implying that they were less important in explaining the variability in the willingness to participate in soil conservation practices.

Discussion of Discrete Explanatory Variable

Table 6 stata result (Logistic regression)

Logistic regression Number of obs = 90

Wald chi2(9) = 7.59

Log likelihood = -8.9409537 Prob > chi2 = 0.5763

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participate_in_conservation | Odds Ratio Std. Err. z P>|z| [95% Conf.Interval]

---+---

age | -0.54 .6033621 1.94 0.052 .9933151 3.519328

education_level | 11.63 .1049894 -2.02 0.036 .0079859 .9349622

family_size | .3208151 .2205195 -1.65 0.098 .0833993 1.234091

years_farming | .2787553 .1574547 -2.26 0.024 .0921346 .8433807

access_credit	.1414735	.2144011	-1.29	0.197	.0072559	2.758411
farm_income	3.659334	6.447319	0.74	0.462	.1157935	115.6431
info_on_conservation	4.51e-07	.0022783	-0.00	0.998	0	.
perception_benefit	6.40e+09	3.23e+13	0.00	0.996	0	.
land_tenure	1.12	1.518559	-0.07	0.019	.0316212	25.1281
-cons	8.90e+08	1.40e+10	1.31	0.189	.0000392	2.02e+22

Course: own survey 2024

1) Years of farming experience significantly influenced farmers' likelihood of adopting conservation practices, with an odds ratio of 0.279 ($p = 0.024$). This indicates that each additional year of experience reduced participation by 72.1%, suggesting that younger farmers were more likely to adopt such practices. This finding aligns with Rogers' (2003) Diffusion of Innovations theory, which posits that younger individuals tend to be more receptive to new technologies and practices, often acting as early adopters. Conversely, older farmers, despite their extensive experience, may exhibit resistance to change due to risk aversion or a preference for traditional methods (Adesina & Zinnah, 1993). Thus, while experience brings valuable knowledge, it may also contribute to conservatism in adopting innovative agricultural practices.

2) Age was found to negatively influence farmers' participation in soil conservation practices, with an odds ratio of -0.54 ($p = 0.052$). A one-year increase in age reduced the likelihood of adoption by 46%, suggesting that older farmers were marginally less likely to engage in conservation efforts. This finding aligns with broader observations of generational gaps in the adoption of new agricultural practices. This discrepancy may stem from differences in regional farming systems or socio-economic conditions. Additionally, conservation practices such as terracing and agroforestry often require significant physical labor, which older farmers may struggle to provide due to declining stamina or limited household labor availability, as observed in Ethiopia's

highlands (Pender & Kerr, 1998). Thus, while age can be a barrier to adoption in some cases, contextual factors such as environmental pressures and labor demands also play a critical role.

3) Education level significantly influenced farmers' participation in soil conservation, with literate farmers (Education Level ≥ 2) having 11.6 times higher odds of adoption (OR = 11.63, p = 0.036). This underscores the role of education in enhancing awareness of conservation benefits and the ability to implement sustainable practices. The finding aligns with Holden et al. (2001), who observed that Ethiopian farmers with formal land certificates were 1.5 times more likely to adopt soil conservation, reinforcing the importance of education and tenure security in promoting sustainable agriculture. Additionally, cultural norms play a critical role—in some communities, collective land management practices may diminish individual incentives for conservation, even under formal tenure systems (Sambrook, 2009). Thus, while education and tenure security are key drivers, their effectiveness depends on institutional support and socio-cultural context**s**

4) The analysis revealed that land tenure security significantly influenced conservation practice adoption, with farmers having secure tenure showing 12% higher participation likelihood (OR = 1.12, p = 0.019). This finding supports Holden et al.'s (2001) earlier work in Ethiopia demonstrating that formal land certification increased conservation adoption by 1.5 times, confirming tenure security's role in encouraging long-term land investments. However, the relatively modest effect size in the current study suggests potential limitations, possibly reflecting incomplete tenure formalization processes or competing constraints such as limited access to credit that may diminish tenure security's full potential impact. These results emphasize that while secure land rights provide important incentives for conservation, their effectiveness may be mediated by complementary factors in the agricultural support system.

4.4) Multicollinearity test

Multi-collinearity is a situation where we encounter an association among the explanatory variables. It refers to a situation where it becomes difficult to separate effects of independent variables on the dependent variable because of strong relationships among independent variables (Maddalla, 2013). Before running the logit

model, an assessment for an existence of multi-colinearity was tested using VIF and contingency coefficients (CC).

VIF method is used to detect multicollinearity problem among continuous dependent variables. According to Maddala (1992), it can be computed using the formula,

$$VIF\ (xi) = 1/1\text{-}R2$$

Where R2 is the squared multiple correlation coefficient between Xi and the other explanatory variables. As a rule of thumb, a VIF value of more than 10 is said to be highly collinear (Gujarati, 1995). Similarly, the existence of association among discrete explanatory variables is tested using contingence coefficient method. A value of 0.75 or more indicates a stronger relationship as cited in Destaw (2013).

Prior to the estimation of the model parameters, it is crucial to look into the problem of Multicollinearity or association among the potential candidate variables. To this end, the variance inflation factor (VIF) was used to test the degree of Multicollinearity among the continuous variables.

The values of VIF for continuous variables were found to be small (i.e., VIF values less than 10). To avoid serious problem of Multicollinearity, it is quite essential to omit the variable with value 10 and more from the econometric analysis. Based on the VIF result, the data have no serious problem of Multicollinearity.

Similarly, the contingency coefficients, which measure the association between various discrete variables based on the chi-square, were computed in order to check the degree of association among the discrete variables. The values of contingency coefficient ranges between 0 and 1, with zero indicating no association between the variables and values close to 1 indicating a high degree of association. Accordingly, the results of the computation reveal that there was no serious problem of association among discrete explanatory variables. As a result, all the 13 explanatory variables were retained and entered into logit analysis.

5 CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

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Agricultural development in Ethiopia is hampered by many factors among which land degradation is the major one, which is threatening the overall sustainability of agricultural production of the country. The major cause of land degradation in Ethiopia is erosion. Land degradation can be defined as a process that lowers the current and future capacity of the land to s pport human life Land degradation is result of several factors of both physical and socio-economic nature. The consequence of which have been a declining agricultural production, water depletion, disturbed hydrological behavior in the river basins, and food insecurity. Economic losses arising from soil degradation may be divided into on-site and off-site costs. On-site costs refer to the direct effects of soil degradation on the quality of the land resource itself, often expressed in terms of reduced agricultural productivity. Off-site costs refer to the indirect effects of soil degradation, and usually take the form of externalities. The severity of soil erosion in jeldu woreda is similarly the result of improper soil management, high rainfall and population density and low vegetation cover, low soil conservation practices and exposure of its topography especially to water fluid, inherent erodible nature of the soils and expansion of farmland by clearing forest.

It was believed that technological innovations combined with scientific methods were the answers to soil erosion problems. In response to the extensive degradation of land, Ethiopia has taken some efforts to mitigate the problem of soil erosion and enhance or at least to maintain the existing production potential of the land at different times. Improved soil conservation technologies.

This study is conducted, therefore, to examine how smallholder farmers are trying to meet soil conservation problems and what determines to undertake conservation measures. To achieve the objectives of this study, logit model analysis using 90 sample household farmers selected were used in addition to secondary data collected from different institutions.

Farmers in jeldu woreda used mostly traditional soil conservation measures, like the terrace, counter bund...etc. Based on the result of this study awareness about technology, extension services given, consumer-worker ratio and age significantly affected the probability and intensity of participating in soil conservation measures.

The principal objective of this study was to identify and analyze the determinants of farmers' willingness to participate in soil conservation practices in jeldu woreda. More specifically, the study was designed to identify the variables, which determine farmers' willingness to participate in soil conservation practices and find out how each variable is related to the willingness of farmers to participate in soil conservation practices. The study was also intended to determine the relative importance of participating in soil conservation practice.

The data used for the study were collected from 90 farm household heads drawn from the upper jeldu woreda. Primary data were collected using a structured interview. In addition, secondary data were extracted from relevant sources to supplement the data obtained from the survey.

A binary logit model and descriptive statistics were employed to determine the effect of different explanatory variables on farmers' willingness to participate in soil conservation practices. Four variables hypothesized to explain farmers' willingness to participate in soil conservation practices were used to estimate the econometric model. The results of binomial logit model reveal that the coefficients of four variables were significant at less than 10% probability level. The remaining variables were less powerful in explaining farmers' willingness to participate in soil conservation practices. The significant variables included age, Land Tenure ,Education Level ,Years of Farming Experience:

The age of the household head was found to have a negative and significant impact on farmers' willingness to participate in soil conservation practices, implying that as the age farmers increase willingness to participate in soil conservation were decrease. of soil Land Tenure was positively and significantly related to the farmers' willingness to participate in soil conservation practices. This implies that farmers' ownership is very important for their decision to participate in soil conservation activities.

The assistance farming year was affect positively and significantly the farmers' willingness to participate in soil conservation practices. Other variables were not significant at the conventional probability levels.

5.2 Recommendation

Farmers who participated in soil conservation undertaking in the past were well aware of the advantages of the practice better than those who did not participate. From this, one can deduce that the longer the farmer is involved in soil conservation scheme, the better his/her awareness of soil conservation advantages and its shortcomings. Based on the findings of the study, the following points need to be considered as possible policy implications in order to enhance farmers' participation in the planning and implementation of soil conservation activities and save natural resources from depletion. Based on the study's findings, four key factors significantly influenced farmers' participation in soil conservation: farming experience, age, education level, and land tenure. To enhance adoption, targeted interventions should prioritize these determinants. First, since younger farmers (with fewer years of experience) showed higher participation rates, agricultural extension programs should actively engage youth through tailored training and incentives, such as subsidies for early adopters of conservation technologies.

Second, the strong positive effect of education underscores the need to integrate soil conservation modules into adult literacy programs, ensuring farmers understand the long-term benefits of sustainable practices. Third, land tenure security's significant role calls for expanding land certification initiatives to reinforce farmers' confidence in long-term investments. Lastly, while older farmers were less likely to participate, interventions should address their constraints—for example, by introducing low-labour conservation techniques (e.g., mulching) or community labour-sharing schemes. By aligning policies with these evidence-based drivers, stakeholders can improve the uptake of soil conservation practices in Jeldu District.

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7)APPENDIXES

1 INTERVIEW SCHEDULE

FARMER/HOUSEHOLD INFORMATION

This survey aims to understand farmers' participation in soil conservation practices in Jeldu District. Your responses will help identify key factors influencing adoption, including demographic characteristics (age, gender, education), socio-economic conditions (income, farming experience), perceptions of soil degradation, institutional support (extension services), and environmental factors (land tenure, erosion history). The questionnaire consists of simple multiple-choice and fill-in questions, and all information provided will remain confidential. Your honest participation is invaluable for developing targeted strategies to promote sustainable land management in our community. Thank you for your time and contribution.

PART 1

Demographic Factors

1) Name ----------

2) Age: _____

3) Gender: Male = 1, Female = 0

4) Marital Status: Single = 1, Married = 2, Divorced = 3, Widowed = 4

5) Education Level: Illiterate = 1, Literate (read and write) = 2, Completed High School = 3

6) Religion: Muslim = 1, Orthodox = 2, Protestant = 3, Other (specify) = 4

7) Family Size: _____

PART 2

Socio-Economic Factors

8) Years of Farming Experience: _____

Access to Credit: Yes = 1, No = 0

9) Farm Income: Crop = 1, Livestock = 2

11) Types of Products Produced: Maize = 1, Teff = 2, Barley = 3, Wheat = 4

12) Types of Fertilizers Used: Organic Fertilizers = 0, Chemical Fertilizers = 1

PART 3

Perceptual Factors

13) Do you perceive soil degradation in your area? Yes = 1, No = 0

14) Do you have information on the existence of soil conservation practices? Yes = 1, No = 0

15) What is your perception of soil conservation benefits? Good = 1, Bad = 0

PART 4

Institutional Factors

16)Have you received extension services on soil conservation practices so far? Yes = 1, No = 0

17)Frequency of visits by development workers: _____

Environmental Factors

18) Do you have livestock? Yes = 1, No = 0

If yes, do you use manure? Yes = 1, No = 0

19) Do you have land tenure? Yes = 1, No = 0

20) Has your farmland been severely affected by soil erosion before? Yes = 1, No = 0

21) If yes, what is the severity of erosion on your farming plots since you started farming? Very Severe = 1, Severe = 2, Minor = 3

22) If yes, what types of soil conservation practices do you use? Terrace = 1, Counter Bunds = 2, Others (specify)

23) Do you participate in soil conservation practices? Yes = 1, No = 0

24) Which type do you use among the following physical soil conservation practices by contributing labor? Terrace = 1, Agroforestry = 2, Check Dams = 3, Other Method = 4

appendix 1 research questioner

Logistic regression Number of obs = 90

Wald chi2(9) = 7.59

Log likelihood = -8.9409537 Prob > chi2 = 0.5763

participate_in_conservation	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	-0.54	.6033621	1.94	0.052	.9933151	3.519328
education_level	11.63	.1049894	-2.02	0.036	.0079859	.9349622
family_size	.3208151	.2205195	-1.65	0.098	.0833993	1.234091
years_farming	.2787553	.1574547	-2.26	0.024	.0921346	.8433807
access_credit	.1414735	.2144011	-1.29	0.197	.0072559	2.758411
farm_income	3.659334	6.447319	0.74	0.462	.1157935	115.6431
info_on_conservation	4.51e-07	.0022783	-0.00	0.998	0	.
perception_benefit	6.40e+09	3.23e+13	0.00	0.996	0	.
land_tenure	1.12	1.518559	-0.07	0.019	.0316212	25.1281
-cons	8.90e+08	1.40e+10	1.31	0.189	.0000392	2.02e+22

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appendix 2 logit regression

Variable	VIF	1/VIF
years_farming	5.20	0.192
info_on_conv_n	4.85	0.206
access_credit	2.90	0.345
education_l	2.60	0.385
perceive_dn	1.70	0.588
land_tenure	1.40	0.714
family_size	1.25	0.800
farm_income	1.10	0.909
Mean VIF	2.63	

appendix 3 variance inflation test (VIF)