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Influence of Farm and Technology Characteristics on Farmers' Perception of Soil and Water Conservation Technologies in West Pokot County, Kenya

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Abstract: *Soil plays significant roles in the earth's life-support system through the provision of a multitude of essential ecosystem services to humans and the environment. But due to severity of soil erosion this ecosystem services are no longer felt at a greater extent in the study area. While farmers' perception of soil and water conservation technologies plays a key role in their decision making on land use and management practices, different farmers may have different attitudes towards soil conservation. Although adoption of agricultural technologies is rigorously researched, the perception component seems to be ignored. Therefore, the main objective of this study was to analyze the influence of farm characteristic and technology characteristics on farmers' perception of soil and water conservation technologies in Chepararia Ward, West Pokot County, Kenya involving 100 farm households. Survey research design was employed using a structured questionnaire. The data obtained was analyzed and the results were presented in tables and frequencies while relationship between variables was analyzed using logistic regression. The findings revealed that conclusion the perception of farmers on soil and water conservation technologies increases when the technology add value to society and not costly.*

Key Words: *Farm Characteristics, Technology Characteristics, Farmers' Perception and Water Conservation Technologies*

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I. Introduction

Soil plays significant roles in the earth's life-support system through the provision of a multitude of essential ecosystem services to humans and the environment these services are vital for sustainable agricultural production, (Bavayeet al., 2016). According to Harrison et al., (2016) ecosystem services that have been proved to play an important role to humans and the environment include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on earth. But due to severity of soil erosion these ecosystem services is no longer felt at a greater extent in the study area. This call for various efforts to reduce unsustainable agricultural productivity which mainly fails due to some factors like need of incentives, technology that needs too much labor, reduction of farm size and lack of awareness according to (Zerssa*et al.,* 2017).

Despite the evident impacts of land degradation and efforts by government and non-governmental organizations to promote use of soil erosion control technologies, uptake of these technologies by farmers is said to be still very low (Muzariet al.,2012). Tessemaet al., (2015) on a study on farmer's decision to adopt conservation tillage, found that farmers were opting for the traditional multiple ploughing over conservation tillage. This is because of farmer's poor perception of soil degradation and its consequences on their production and productivity.

Although adoption of agricultural technologies is rigorously researched, the perception component seems to be ignored. It is the perception of the decision makers, that plays an important role in their final economic decision; such as whether to adopt a certain technology/ SWC practice or not as indicated by (Fosu-Mensahet al., 2012).This view is supported by Teshome *et al.*,(2014) who noted that farmers perception and decision making has not well been understood. The study concluded that investing on land management practices reduces land degradation hence increasing food production. This raises

concern on the study of analysis of factors influencing farmers' perception of soil and water conservation technologies in West Pokot County, Kenya.

1.2 Research Objectives

[1]. To determine the effect of farm characteristics such as land tenure, severity of soil erosion and land terrain on farmers' perception of SWCT.
[2]. To evaluate how technology characteristics influences farmers' perception of SWCT.

II. Methodology

The study employed a survey research design involving 100 farm households randomly selected from a population of 7495 in Chepararia Ward, West Pokot County, Kenya. In the collection of primary data, a questionnaire was administered to randomly select farmers.Descriptive statistical analysis was used to compute the percentages and frequencies of independent variables. Logistic regression model was used to analyze the effect of different variables on farmers' perception of soil and water conservation technologies. This is because logistic regression model allows the prediction of discrete outcome for set of variables that may be continuous discrete and dichotomous, that is generated from the questionnaire survey as a binary response.

III. Results

3.1 Farm Characteristics and Perception of Soil and Water Conservation Technologies

Thepurpose of this study was to investigate how land ownership, land severity/degradation status and land terrain influenced farmers perception of soil and water conservation technologies. The findings are shown in Table 1.

Table 4 1: Perception of Independent Variables

Parameters	S A Freq/%	A Freq/%	U Freq/%	D Freq/%	S D Freq/%	Total
Influence of farm characteristics on perception farmers of SWCT						
Land ownership	65	17	2	7	9	100
Land terrain	41	36	8	4	11	100
Land degradation	56	21	3	6	14	100
Influence of technology characteristics on perception of farmers of SWCT						
Complexity of technology	36	31	6	10	17	100
Cost of technology	45	33	6	8	8	100
Relative advantage of technology	71	18	4	3	4	100

3.1.1 Land Ownership Influence on Farmers Perception of Soil and Water Conservation Technologies

The study findings in Table 1shows that proportion of (65 percent strongly agreed and 17 percent agreed) that land ownership is a major influence of their perception of soil and water conservation technologies, majority arguing that it was easier for them to adopt a technology when they own land. It will be uneconomical to invest in a land when you are not the owner. The root cause of high severity in other parts was due to communal ownership in the past as concluded by most farmers interviewed. Lesser proportions (2 and 7 percent) were undecided and disagreeing respectively. Since they have demarcated their lands, crop cover has improved and every individual are trying to reclaim the degraded lands.

3.1.2 Influence of Land Terrain on Farmers Perception of Soil and Water Conservation Technologies

Land terrain is the gradient of the land. This survey study was trying to find out the influence of land terrain on farmers' perception of soil and water conservation technologies. Majority (41 percent strongly agreeing and 36 percent agreeing) that land terrain influencing their perception of soil and water conservation technologies. Farmers residing on steep slopes area, believed in practicing stone-line and terraces technology for the purpose of preventing soil erosion and increasing soil fertility. Farmers mentioned their way of livelihood is agro-pastoralism having transitioned from pastoralism. This could be a motivating aspect for them to implement soil conservation measures to improve soil fertility and crop productivity despite land terrain Table 1.

3.1.3 Influence of Land Degradation on Farmers Perception on Soil and Water Conservation Technologies

Table 1 further shows (56 percent strongly agreeing and 21 percent agreeing) that land degradation influences their perception of soil and water conservation technologies, three percent

undecided and six percent disagreeing land degradation being their major influence on how they perceive soil management technologies. This is because from the study different individual with different landscapes gave their responses and this could be individuals from sloppy areas. The study also found that some farmers were shifting their residential places due to collapse gullies approaching their home state. The study also intended to seek farmers' responses regarding their perception of land degradation.

3.1.4 Technology Characteristics and Perception of Soil and Water Conservation Technologies

The study intended to seek farmers' responses on the influence of technology characteristics on farmers' perception of soil and water conservation technologies. The frequencies are presented in the table 1.From (table 1) proportion of (36 percent strongly agreeing and 31 percent agreeing) that technologies are easy to implement. The farmers were referring to live fence technology, while those referring technologies to be costly were at (45 percent strongly agreeing and 33 percent agreeing) were referring to gabion and sand dams, this is because it needs a lot of man power and cost of material is high. Majority (71 percent strongly agreed and 18 percent agreed) that soil and water conservation technologies are of significant importance, majority mentioning increasing food security as a key aspect. This is as a result of improved soil fertility. A few (4 percent undecided 3 percent disagreeing and 4 percent strongly disagreeing) that soil and water conservation technologies is of no significance and add no value to their livelihood.

3.3 Logistic Regression Results and Test of Hypotheses

Given the nature of structured questionnaires in the study, logistic regression model was an appropriate model to analyze factors under investigation to determine their influence on farmers' perception of soil and water conservation technologies, given that the dependent variable was dichotomous discrete variable while the independent variables are mixture of discrete and continuous. A five likert (strongly agree to strongly disagree) scale was used. Results from the logistic regression are shown in Table 2.

Table 2. Logistic Regression Results for Farmers Perception of SWCT

Logistic Regression				Number of Obs = 100 LR Chi^2 = 53.19 Prob>Chi^2 = 0.0000 Pseudo R^2 = 0.5369
Log likelihood= -23799				
Perception of SWCT	Coefficient.	Standard. Error	Z	p>|z|
Land ownership	0.499964	0.5135903	1.97	0.049*
Land terrain	1.052552	0.9262621	2.76	0.006*
Land degradation	0.385563	0.3786312	2.54	0.011*
Complexity of Technology	0.111441	0.1814297	0.61	0.539
Cost of Technology	1.178772	0.4377175	2.69	0.007*
Importance of Technology	-0.720825	2.218042	-3.06	0.002*
Constant	-1.636314	0.5655994	2.89	0.004*

Logistic regression results in Table 2 showed land ownership had significant influence (p = 0.049<0.05) to farmers perception of soil and water conservation technologies.The terrain of the land had a positive significant effect on the farmers' perception of soil and water conservation technologies (β = 1.05255, p = 0.006< 0.05). This might be because the structures of soil and water conservation take more area of land that could have been used to produce crops and also limiting accessibility of machinery and oxen ploughing.

Land degradation was another aspect that was found to have positive and significant (β =0.385563, p=0.011< 0.05) influence on farmers' perception of soil and water conservation technologies. This indicates that when the land is extremely degraded, it requires technical expertise during construction of conservation measures which is time consuming and costly. This implied that the first null hypothesis that land tenure, land terrain and land degradation does not affect the farmers' perception of SWCT was rejected and concluded that land terrain, land ownership and land degradation influences the farmers' perception towards SWCT. This finding is supported by the results that most respondents perceived that the situation of extremely degraded lands cannot be solved.

Complexity of technology had a positive but insignificant influence (β=0.1114, p=0.539>0.05). Whereas cost of technology was another aspect which had a positive significant (β=1.178772, p=0.007) influence to farmers' perception. Farmers tend to have positive perception when the technologies are cheaper to implement, and less costly in management process.

Relative advantage of technology depicted a negative significant (β= -0.720825, p=0.002) influence to farmers perception of soil and water conservation measures. This implied that as importance

of technology increases in terms of soil fertility, water retention, reducing surface runoff and reclaiming land in general, farmers perception of technologies reduces, this is because farmers believe their land to have restored its fertility, and taking up of soil conservation measure will not be of much importance. This implied that the second null hypothesis that complexity of technology does not affect the farmers' perception of SWCT was accepted whereas the null hypothesis that cost and importance of technology does not affect perception of SWCT was rejected and conclude that the alternative hypothesis that cost and importance of technology affected the farmers' perception on SWCT.

IV. Discussions

Land ownership was one of farm characteristics determining farmer's perception of soil and water conservation technologies and it showed a significant with (p=0.049) at 5 percent level of significance. Due to a positive coefficient (β= 0.499) of land ownership status, this would influence the perception of farmers of SWCT. This agrees with the study by Grimm and Klasen, (2014) who stated that in relation to land management, the 'assurance effect' of land security provides a guarantee to farmers to invest in both short and long-term soil management practices. Further, Tenaw, *et al.,* (2009) noted that farmers do not feel emotionally attached to cultivate or invest in the land development and will not use inputs efficiently without secured property. It concurred withTeshome*et al.,* (2014) stating that secured land tenure has been widely demonstrated to play a critical role in influencing farmers' willingness to invest in soil conservation practices.

Logistic regression results of land terrain showed positive significance to perception of farmers of soil and water conservation technologies (β=1.052, p=0.006,) at 5% level of significant. Alufah*et al.,* (2012) stated that the slope of farm lands, influences farmer decision to have better perception of soil and water conservation technologies. This agrees with the study by Moges*et al.,* (2017), which stated that farmers are likely to invest on conservation measures where their farm plots are located at higher slopes, because soil erosion is more visible to farmers at higher steeper slopes than plots located at flats areas and forced the farmers to use conservation measures. In relation to Beley (2014), the main causes of land degradation perceived by farmers were the slope of the land, deforestation, improper farming practice and high intensity of rainfall and absence of appropriate soil conservation practice

Also according to Dimtsu (2018), most of the farmers perceive steep slope of their land as the determinant physical causes of soil erosion. This shows that soil erosion is sensitive to specific physical factors such as slope, elevation, aspect, and terrain units as investigated by Farhan*et al.,* (2014).Land degradation also depicted significance (p= 0.011) at 5% level of significant table 4.7. This indicates that farmers with high degraded land status in their farms are perceived to implement measures of restoring degraded land, the positive coefficient (β=0.38) shows that farmers' perception increases with increase in land degradation.

From table 1 a majority (36 percent strongly agreed and 31 percent agreed) that the technologies are easy to implement. In this case farmers were referring to live fence technology. This agrees with Mbugua (2009) who stated that farmers make decisions for adoption basing on the suitability of a technology and their perception of technology specific attributes, such as complexity which in most cases is the hindering factor to adoption, cost of technology and its importance which influence farmers' subjective decision to adopt or reject a technology. Respondents referring technologies as expensive were at 45 percent strongly agreeing and 33 percent agreeing. They were referring to gabion and sand dams. This is because it needs a lot of man power and cost of material is high.

The sampled respondents (71 percent strongly agreed and 18 percent agreed) that soil and water conservation technologies are of significant importance (β= -0.7208, p=0.002) at 5% level of significance, majority mentioning increasing food security as a key aspect this is as a result of improved soil fertility. This concurred with study by Zerssa*et al.,* (2017) stating that farmers who implement conservation technologies observed better growth and development of crop. It was further supported by Malenga and Maseko (2015) indicating that farmers are likely to adopt technologies that are easy to implement, less costly and those that have added advantage to their livelihood. (Teshome*et al.,* 2014) reported that soil and water conservation technologies being very important in improving soil fertility and crop production.

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