HUNGARIAN UNIVERSITY OF AGRICULTURE AND LIFE SCIENCES

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ANALYSIS OF THE ADOPTION OF SOIL AND WATER CONSERVATION TECHNOLOGIES IN SELECTED SUB-COUNTIES OF MOUNT ELGON REGION, UGANDA

Supervisor: Dr. Csorba Ádám

Head of Institute: Prof. Erika Micheli

Created by: Mirembe Staden

Neptun: H7HZJO

Full-Time

Gödöllő

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DEDICATION

This piece of work is dedicated to my incomparable colleagues, friends and my beloved parents for the unwavering love and their great contribution in terms of finance, encouragement and material support for which enabled me to reach this level of milestone in my academic career.

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Acronyms and Abbreviation

CBO	Community Based Organisations
FAO	Food and Agriculture Organization
HH	Household Heads
HUF	Hungarian Forints
KI	Key Informant
Mt.	Mount (ain)
NARO	National Research Organization, Uganda
NEMA	National Environment Management Authority, Uganda
NGO	Non-Governmental Organization
SDG	Sustainable Development Goal
SPSS	Statistical Package for Social Scientists
SSA	Sub-Sahara Africa
SWC	Soil and Water Conservation
SWCT	Soil and Water Conservation Technology
UBoS	Uganda Bureau of Statistics
UGX	Uganda Shillings
UN-DESA	United Nations Department of Economic and Social Affairs
UWA	Uganda Wildlife Authority

ABSTRACT

The high rates of land degradation viewed as the main cause of declining soil fertility and subsequently reduced agricultural productivity have become a major concern in Sub-Saharan Africa (SSA). To mitigate this unfortunate scenario, Soil and Water Conservation (SWC) measures have been advocated for in various parts of SSA. Despite this advocacy, the adoption rate of these technologies remains low. This research, therefore, sought to find out the SWC technologies practiced by farmers along the eastern slopes of Mt Elgon Uganda, the factors influencing the adoption of these technologies, and challenges faced by farmers in the adoption of Soil and Water Technologies (SWCTs). The study employed a descriptive explanatory research design where a survey of 139 farmers was carried out and the data analysed at a 95% confidence interval and 5% error value. Primary data was collected using Household questionnaires and Key Informants Interviews (KII) in the study area. Farmers were selected from six sub-counties proportionately based on households as a sampling frame to fill a semi-structured questionnaire. One respondent per household was recruited by simple random sampling. Data collected was collated, coded, and analyzed using the SPSS version 27 to answer the three research objectives. Spearman correlation coefficient was used to answer objective three. Study results were presented using tables, charts, and verbatim quotations. The key findings indicate that farmers in the Mount Elgon region practice various Soil and Water Conservation Technologies (SWCTs), such as mulching (47.5%). agroforestry (5%) and terracing(4.3%). Adoption of SWCTs is influenced by factors including farmer education level, access to credit, extension services, and land tenure system.

Based on the study's findings, the study recommends that policymakers prioritize education and extension services to encourage the adoption of SWCTs among farmers in the Mount Elgon region. Access to credit should also be improved to finance the implementation of conservation practices, and secure land tenure policies should be put in place to encourage investment in conservation practices. Future research should focus on the economic and environmental benefits of SWCTs to encourage more farmers to adopt these practices. Additionally, extension services should provide farmers with accurate and reliable information on SWCTs, and social networks and farmer-to-farmer learning platforms should be developed. Finally, further research is recommended to explore specific barriers and opportunities for the adoption of SWCTs in the region.

1.0 INTRODUCTION

1.1 Background of the study

One of the biggest challenges to agricultural productivity in most developing countries is the issue of diminishing soil fertility (Raimi et al., 2017) Various reasons account for this trend, including soil degradation processes, desertification, continued extractive farming practices, poor agronomic practices, limited use of critical agricultural inputs, and minimal efforts to reverse soil degradation (Tittonell, 2014). Climate change shocks and the resulting hydrological extreme events and competing demands for limited soil resources have aggravated the problem (Raymond et al., 2020). In many developing countries, declining soil fertility is now considered a threat to food security (United Nations Department of Economic and Social Affairs [UN-DESA], 2013).

Low soil fertility is one of the key problems affecting small-scale agriculture output, especially in low-potential areas throughout Africa. Most life support systems rely on the soil as it is the most valuable and widespread natural resource and the agricultural economy's engine. However, poor farming practices, soil erosion, and consequently reduced soil fertility have resulted in a steady decline in land productivity. Soils are considered life enablers due to their ecosystem services on Earth. Nutrient cycling; water purification, soil contaminant reduction, and freshwater storage; carbon sequestration; the foundation for human infrastructure; flood regulation; habitat for organisms; provision of construction materials (Chandrasekhar, 2018; FAO, 2015b; Keesstra et al., 2016). Indeed, Wawire (2020) asserts that, soil must be kept healthy to perform most of these tasks.

The importance of these ecosystem functions and services places soil (and agriculture) at the center of the Sustainable Development Goals (SDGs) (Tóth et al., 2018). The increasing global population puts pressure on natural resources (including water, land, and nutrients), necessitating sustainable soil management to ensure adequate food supply and achievement of zero hunger (SDG2). Similarly, environmental issues like land degradation, soil erosion, and loss of soil organic carbon (SOC) are linked to poor environmental quality, putting millions of people's lives at risk (Hou et al., 2020; Keesstra et al., 2016). These include no poverty (SDG 1), good health and well-being (SDG 3), clean water and sanitation (SDG 6), climate action (SDG 13), and life on land (SDG 15). And that soil is indirectly significant in achieving the other SDGs (Chandrasekhar, 2018; Keesstra et al., 2016) Thus, the increasing interest among the scientific community in finding ways to sustainably manage this resource and stem the runaway soil fertility decline, which has been a trademark of soils in Sub-Saharan Africa (SSA) (Food and Agriculture Organization (FAO), 2015; Olsson et al., 2020; Stewart et al., 2020; Tully et al., 2015; Vanlauwe et al., 2015).

Changes in climate, topography, soil characteristics and agricultural practices pose serious threats to human and environmental survival (Tully et al., 2015). Agricultural practices cause salinisation, erosion, compaction, desertification, and pollution (Olsson et al., 2020; Wawire, 2021). Understanding the issues affecting soil resources is critical to addressing them and ensuring that soil functions effectively. In response to this reality, national, regional, and international interest is growing in strategies to improve and sustain healthy soils.

The wise use of land resources, erosion control and water conservation technologies, and appropriate cropping patterns improve soil productivity and prevent land degradation (Tiwari et al., 2008). Several government agencies and non-governmental organizations have worked to improve the situation in many agricultural zones in Uganda. This includes technologies such as Soil and Water Conservation (SWC) demonstrated and promoted by organizations like the National Research Organization (NARO) in Uganda. Furthermore, numerous technology uptake paths have been established through which new technologies reach end-users.

1.2 Problem statement

The high rates of land degradation viewed as the main cause of declining soil fertility and subsequently reduced agricultural productivity have become a major concern in Sub-Saharan Africa (SSA) (Mbaga-Semgalawe & Folmer, 2000; Tiwari et al., 2008). To mitigate this unfortunate scenario, soil and water conservation measures such as mulching, grass strips, and retention ditches have been advocated for in various parts of Sub-Saharan Africa. Despite this, the adoption rate of these technologies has remained low (Mugonola et al., 2013). The situation in the Mt Elgon region and most of Uganda is similar (National Environment Management Authority (NEMA)-Uganda, 2019). Conservation and subsistence farming collide on the slopes of Mt. Elgon. As a result, land degradation has been reported, with heavy rains causing floods and landslides that have claimed lives and destroyed property (Musau, et al., 2014). Land degradation has also posed a significant threat to the region's rich biodiversity, affecting thousands of people and their livelihoods through ecological services and products (Petursson et al., 2006). Mount Elgon's situation appears to be both an ecological and a socio-economic challenge that must be overcome.

As a result, this research aims to document the various Soil and Water Conservation Technologies (SWCTs) used on the slopes of Mount Elgon in eastern Uganda and the factors that influence their adoption.

1.3 Objectives of the Study

1.3.1 Main objective

The main objective of the research was to establish the factors influencing the adoption of SWCTs in selected sub-counties of the Mount Elgon region, eastern Uganda

1.3.2 Specific Objectives

i. To find out the SWCTs practiced by farmers along the slopes of Mt Elgon
ii. To find out the factors influencing the adoption of SWCTs by farmers along the slopes of Mt Elgon
iii. To establish the significance of the relationship between SWCTs implemented and the factors influencing their adoption along the slopes of Mt Elgon

1.3.3 Research questions

a) Objective one

i. Which SWCTs are practiced by farmers along the slopes of Mt Elgon?
ii. Which SWCTs are considered most effective by farmers along the slopes of Mt Elgon?

b) Objective two

i. What labor-related factors influence the adoption of SWCTs amongst farmers along the slopes of Mt Elgon?
ii. What costs and profitability factors influence the adoption of SWCTs amongst farmers along the slopes of Mt Elgon?
iii. What Social factors influence the adoption of SWCTs amongst farmers along the slopes of Mt Elgon?
iv. What are the common land tenure systems along the slopes of Mt Elgon?
v. How do land tenure systems influence the adoption of SWCTs amongst farmers along the slopes of Mt Elgon?
vi. How do physical factors influence the adoption of SWCTs amongst farmers along the slopes of Mt Elgon?

vii. What are the common courses of information on SWCTs amongst farmers along the slopes of Mt Elgon?
viii. How does access to information and awareness influence the adoption of SWCTs amongst farmers along the slopes of Mt Elgon?

c) Objective three

i. What relationship exists between SWCTs and the socio-economic factors influencing their adoption along the slopes of Mt Elgon?
ii. What relationship exists between SWCTs and the physical factors influencing their adoption along the slopes of Mt Elgon?

1.4. Significance and Justification of the study

The findings from the study was of benefit to the government to help guide policy formulation and to refocus SWC programmes in not only the study area but the larger Uganda as a country. The study findings will also serve as an indirect way of evaluating the effectiveness of their past programmes and initiatives. I will also inform the government why past strategies did not succeed or get adopted by farmers. And therefore, the government was able to remedy the situation. Study findings on the factors affecting the uptake of SWCTs among farmers will enable agricultural extension officers to mount more effective awareness programmes. Agricultural extension officers will use the study's recommendations to carry out their duties and responsibilities in SWC effectively.

On the other hand, Non-Governmental Organisations (NGOs) involved in SWC and other agricultural activities will use the study findings to solicit funds and prioritise their funding activities and programs to specific areas, target groups, and initiatives. The study findings will enable identifying new areas for local community capacity building and socio-economic development. The study findings will enable NGOs to lobby the government for policy formulation on SWC and roll out programmes for sustainable agriculture and SWC.

The local community was one of the direct beneficiaries of the study findings during and after the research through awareness creation. The study will also provide a platform for farmers to share their views and have a knowledge exchange on SWC practices with other stakeholders. Study results and recommendations on SWC practices will enable farmers to engage in sustainable agricultural practices that will enhance agricultural productivity and, consequently, sustainable livelihoods.

Implementing SWC practices implies sustainability of the resources upon which life support systems hinge; therefore, study findings will enhance the realization of sustainability, healthy soils, and water conservation, which in turn equates to a healthy environment. Soil erosion and landslides have been a perennial challenge along the steep slopes of Mt Elgon; study findings will guide the sustainable management of soil and water resources along with this fragile environment and therefore mitigate land degradation. The study will document the SWCTs and practices around Mt Elgon in Uganda, thereby adding to knowledge. In addition, the current study will serve as a springboard for other similar studies.

1.5. Scope of the study

The research will seek to establish the soil and water conservation technologies practiced on the slopes of Mt Elgon and the factors influencing the adoption of these technologies. The study will mainly target farmers as key stakeholders from six sub-counties, including Bukhalu, Buyaga, Nabbongo, Bukiise, Buhugu, and Bumalimba, from two districts of Bulambuli and Sironko within the Mt Elgon area.

The research study was carried out during the 2021/2022 and 2022/2023 academic years of the Hungarian University of Agriculture and Life Sciences. It will mainly use Key Informants (KI) and structured questionnaires for data collection.

1.6 Assumptions and limitations of the study

The study assumes that the data sought for the research was available and that which was collected from the respondents was true and free from any prejudice. The study also assumes that the household heads own and have access rights to agricultural land in the study area. The study also assumes that the planned time was adequate and was no natural or social disruptions during the data collection exercise in the study area.

2.0 LITERATURE REVIEW

2.1. Introduction to the chapter

This chapter reviewed the literature on soil and water conservation (SWC) technologies worldwide, critiquing their advantages and disadvantages. The review went further to establish the factors that affect the adoption of these SWC strategies around the globe.

2.2. Soil and Water Conservation Technologies (SWCT)

Soil is the top layer of the Earth's surface and is made up of minerals, gases, organic materials, and micro-organisms. It is a scarce resource essential for maintaining ecosystem functions, human life, and agricultural output. Soil is vital to all life on Earth as a natural habitat for insects, microbes, and small creatures. Soil may also absorb and filter water, making it more resistant to floods and droughts. Soils contain more carbon than the atmosphere and all plants combined, indicating their importance in storing carbon and reducing emissions, thereby helping to slow global warming. Soil and all its constituent elements, together with water, form prime assets in any productive agricultural land, which should be managed sustainably (Chandrasekhar, 2018; FAO, 2015b; Keesstra et al., 2016).

According to Bigeye (2016), in a keynote speech made during the World Economic Forum on Africa, 70% of Africans rely on agriculture for survival, making the sector a vital component of all African economies. Therefore, its expansion is critical to improving wealth, food security, industrialization, intra-African commerce, and Africa's global trade contribution (Asfaw & Neka, 2017; Biteye, 2016; Karidjo et al., 2018; Mlenga & Erla, 2019). It has been observed that agricultural success is intertwined with economic development in Africa, and therefore, any long-term agricultural productivity development must be environmentally sustainable. Soil and Water Conservation (SWC) technologies have been found to prevent erosion, enhance soil moisture, and increase land productivity (Bagheri & Teymouri, 2022; Njenga et al., 2021; Tu et al., 2021; Wolka et al., 2018). For this reason, many people believe that SWCTs can boost agricultural productivity while also being more environmentally friendly. In Ethiopia, where soil degradation threatens sustainable land use and thus national food security, researchers have studied the efficacy of SWC methods (Enawugaw et al., 2020; Fontes, 2020; Tadesse & Belay, 2004; Teshome et al., 2013).

Moreover, as the population grows, so does food consumption, especially in Africa, where population growth is predicted to be the fastest (European commission, 2013; UN-DESA, 2021). Increased food needs will likely strain and increase competition for natural resources, affecting the ability to produce food. In this regard, more environmentally friendly agriculture strategies are required to meet global food needs. Promoting more ecologically friendly farming methods like SWCT (Soil and Water Conservation Technologies) seems like a noble idea in this context. In principle, SWCT might help reduce environmental deterioration while preserving or boosting agricultural productivity (Amfo et al., 2021; Nyamekye et al., 2018; Ojo et al., 2021).

Communities living in mountainous areas have evolved robust systems and solutions to adapt to their challenging conditions (Moges & Taye, 2017). Most mountain peoples subsist on farming, forestry, pastoralism, and fishing. However, climate change, land-use change, deforestation, and overgrazing have continued to harm soil and water conservation in the mountains (FAO, 2015b). Floods, landslides, debris flows, and soil erosion increase in mountain locations with rapidly growing populations and inadequate infrastructure. Climate change exacerbates these dangers by increasing the frequency of extreme occurrences like floods, droughts, and glacier melt. Hence, these factors have made mountain peoples, livelihoods, and food security more vulnerable.

Soil and water erosion are significant sources of land degradation, a critical global concern. Whether caused by natural or human factors, soil erosion has short- and long-term adverse effects on-site and off-site. Many studies believe that anthropogenic activities degrade soils and water resources (Ashoori et al., 2016; Darkwah et al., 2019; Huang et al., 2020; Mugonola et al., 2013; Y. Wang et al., 2022). Various countries have mounted diverse soil and water conservation technologies to mitigate this global challenge; agroforestry, mulching, bench terraces, conservation farming, and integrated nutrient management. Other techniques include crop rotation, intercropping, fallowing, water harvesting options such as tied ridges and pond construction, floodwalls, and dams, dredging and weeding of irrigation canals(Bagdi et al., 2015; Das & Bauer, 2012; Enawugaw et al., 2020; Kpadonou et al., 2017; Moges & Taye, 2017; Mugonola et al., 2013).

2.2.1 Agroforestry

Contour hedgerow systems have been wide to reduce soil erosion, restore soil fertility, and increase crop yield (Hussain et al., 2021; Karidjo et al., 2018; Lei et al., 2021). Along the contours, twin hedgerows of trees or shrubs are planted at 4-6 m intervals, with the lanes between the hedgerows being food crops (Noordwijk & Verbist, 2021). Leguminous hedgerow trees are usually favored and pruned to avoid shading food crops and the biomass used as green manure, mulch, or animal feeds. Natural terraces at the base of hedgerow trees reduce soil erosion and surface runoff (Lei et al., 2021). Terrace formation is faster with ploughing than with no-till or manual tillage. This technology is commonly used in extension initiatives for sustainable agriculture. Despite favorable results recorded in several experimental and demonstration sites, upland farmers have not generally implemented this invention in China (Lei et al., 2021). Further to this observation, due to the required labor input, hedgerow intercropping is not attractive on flat land but for Mountain slopes. Improving soil fertility and crop yields like profitable trees, crops, or feed may theoretically pay for labor.

2.2.2. Fallowing

Arable land is planted with food crops for a few years before being left fallow to regenerate the soil in the highlands and mountainous areas (FAO, 2015b). This is an upgraded form of traditional shifting cultivation (Misebo, 2018). Leguminous trees can be planted to reduce the fallow period, and after reviving the soil, the trees are cleared for agriculture. 40-50 cm wide strips are left unplugged over the field when ploughing along contour lines. The strips' natural vegetation filters degraded soils, slows water flow, and improves water infiltration, making them excellent soil and water conservation tools.

These natural vegetative contour strips have several advantages, say researchers. Farmers benefit from the leguminous trees planted in terms of forage, woodlots, and humus from the shed leaves, which reduces the quantity of nitrogen needed as a fertilizer (FAO, 2015b; Hussain et al., 2021; Noordwijk & Verbist, 2021). In addition to the benefits above, trees are felled, and their branches stacked up along the contours to stop erosion, and with time natural terraces eventually grow, levelling steep hillsides. These arguments notwithstanding, an interest in fallowing amongst the contemporaries as a drought adaptation strategy has increased due to frequent droughts in most parts of the world (Fantini et al., 2017; Fernandes et al., 2022; Manalil & Flower, 2014; Schillinger

& Wuest, 2021; Wietzke et al., 2020). However, there is contradictory evidence of the current fate of this traditional, integrated agricultural system like farrowing has less impact on farmers' livelihoods and ecosystem conservation compared to contemporary farming systems (Fantini et al., 2017).

2.2.3. Natural vegetative / grass strips

Natural vegetative / grass strips are easy to establish and maintain alternatives as they are appealing due to minimal intervention(FAO, 2015b). About 40-50 cm wide strips are left un-ploughed across the field when plowing along contour lines. These strips are placed down the hill at predetermined intervals. The suggested practice for spacing contour buffer strips has been to place them at every one-meter drop in elevation; however, greater spacing is often acceptable (FAO, 2015b; Hussain et al., 2021; Noordwijk & Verbist, 2021).

A grass strip is a ribbon of grass planted along a cultivated land's contour. Grass strips are usually one meter wide and one meter vertically. They are utilized to change soil structure with good infiltration on gentle slopes. A grass strip helps sustain *Fanya juu* and soil bund in a farm plot by reducing runoff and filtering sediments. If the grass strips grow, they will form a terrace and offer cow fodder. Majority of farmers (78.3%) chose this strategy since it requires less labor and uses Fanya juu as a bund stabiliser (Damtew Atnafe & Maru Ahmed, 2015). Grass, legumes, trees, and bushes are grown for several uses. Revegetating saves soil and stabilises bunds and other structures. They work well if cattle are kept off grass all year, despite offering feed for livestock.

2.2.4. Conservation farming/ Minimum tillage/zero tillage.

Conservation Tillage is any form of soil cultivation that leaves crop residue on fields before and after planting to prevent soil erosion and runoff, among other benefits. Using tillage strategies that increase soil fertility and water conservation minimises labor in land preparation. Conservation tillage follows four rules; permanent soil cover, stubble mulch tillage, crop choices, and rotations (Misebo, 2018). Some researchers opine that in minimal/zero tillage simple farm tools like hoes and digging sticks are used to prepare the soil and plant food crops (Nugroho et al., 2022).

Conservation tillage is widely employed in water and wind-eroded areas where intercropping, ridging, no-tillage, herbicides, and straw mulching are utilized as treatments (Tan et al., 2015). Farmers in shifting cultivation are comfortable with minimum tillage. While intense tillage enhances topsoil porosity and reduces surface barriers to infiltration, it normally disrupts macro-pore continuity and can impede deep penetration, especially if a plough pan is produced (FAO, 2015b; Noordwijk & Verbist, 2021). No-till systems on non-plowed or non-compacted soils often preserve high infiltration rates of forest soils. Transitioning from ploughing to minimal tillage generally involves years of reduced infiltration before earthworms and other soil engineers re-establish a new continuous macro-pore system (Noordwijk & Verbist, 2021).

Smallholder farmers in most developing countries dependent on agriculture commonly use crop rotation in SWC (Amfo et al., 2021; Huang et al., 2020). It involves alternating grain with pulse or oilseed crops, and as a result, crop residue and waste management are simplified. Crop rotation lowers soil erosion while enhancing soil structure and water percolation and thereby aids in climate change adaptation (van Antwerpen et al., 2021). The crops planted are chosen for the same reasons: better soil physical and nutrient condition interrupts the weed/pest/plant disease cycle (Tan et al., 2015; van Antwerpen et al., 2021).

2.2.5. Bench Terraces and Soil bunds

Bench terraces are utilized on sloping grounds of up to 40% with deep soils to store water and control erosion (Teshome et al., 2013). It has been observed that dykes are sensitive to erosion and are occasionally reinforced with stones or concrete. Terraces are made by cutting the soil into level steps or benches that allow water to permeate into the soil slowly. Bench terraces are ideal for irrigated rice systems (Ashoori et al., 2016; Das & Bauer, 2012). For dyke protection, larger fruit trees could be used with a wider spacing boosting revenue on those terraces.

On the other hand, a soil bund is a contoured embankment with an upper water gathering channel or basin (Damtew Atnafe & Maru Ahmed, 2015). A soil bund is where a ditch is excavated following the contour, and the dug-out soil is dumped down the slope from the contour trench to build a ridge upslope. It reduces the slope length of the field, which reduces and prevents runoff velocity. It is usually built-in fields with a slope of less than 10%. FAO (2015) observes that soil bunds effectively control soil loss, retain moisture, and eventually increase land production.

2.2.6. Fanya juu

The *fanya juu* terrace is a structural method of soil conservation that has been widely practiced on small, labour-intensive farms in Kenya and now widely implemented globally. A technology that was highly advocated for in the early 1980 for SWC in the arid and semiarid lands of South Eastern

Kenya (Saiz et al., 2016). In Swahili the term *fanya juu* means "throw it upwards". As a SWCT, it refers to the practice of digging a ditch on the contour and throwing the soil uphill to form an embankment, which is subsequently stabilized by planting grass (Saiz et al., 2016). *Fanya juu* are field barriers based on the same design concepts as soil bunds. However, unlike soil bunds, *fanya juu* requires a trench dug, and the excavated earth is tossed downward rather than downward (FAO, 2015b; Noordwijk & Verbist, 2021). The main purpose is to prevent water and soil loss and to make conditions more suitable for plants to grow. A terrace builds behind these barriers with time, preventing further erosion (Herweg & Ludi, 1999). *Fanya juu* terraces take up less room than soil bunds and speed up bench development; thus, space complaints can be minimised considerably(FAO, 2015; Noordwijk & Verbist, 2021). The *Fanya juu* slows or stops the surface runoff and therefore soil erosion. Their aim in semi-arid areas is to harvest and conserve rainfall, whereas, in sub-humid zones, contour bunds are constructed to discharge excess runoff. Experts opine that because *Fanya juu* terraces serve as subsurface irrigation, the crop does not suffer from a lack of moisture (Bagheri & Teymouri, 2022; Damtew Atnafe & Maru Ahmed, 2015).

Because the excavated earth is thrown downward rather than uphill, soil bunds need less labor than *fanya juu*. Furthermore, waterlogging or washing away deposited soil in the ditch behind the soil bund is possible. Moreover, the accumulated dirt will raise the bunds instead of crops in later years. The *fanya juu* terraces' bunds are made chiefly of subsoil. The drainage behind the bund is thus less affected than regular dirt bunds. Although expensive at the onset in terms of labour, time, or cost implication, *fanya juu* is more effective and sustainable than soil bunds in the long run(Damtew Atnafe & Maru Ahmed, 2015; Njenga et al., 2021; Noordwijk & Verbist, 2021).

2.2.7. Cut off drain and waterways

This channel collects runoff from the land above and safely diverts it to a stream or river, preventing soil erosion (Damtew Atnafe & Maru Ahmed, 2015). Given that water channels are simple to build and can be used on all cultivated land, farmers have widely adopted them. In locations with high rainfall, they are built along the slope and often covered with grass to minimize damage (Moges & Taye, 2017; Noordwijk & Verbist, 2021). A Cut off drain collects runoff from the land above and safely divert it to a stream or river, preventing soil erosion. In locations with high rainfall, they are built along the slope and often covered with grass to minimize damage. These drains prevent crop loss from uphill water flowing onto the plot. The facts above notwithstanding, farmers claim that cut-off drains are prone to erosion due to the high flow rates they must handle. A gully should be avoided by proper design, construction, stabilization, and maintenance. Waterways used for soil conservation usually have a vegetative lining to protect them. Plants safeguard the channel by slowing the flow near the bed and covering and matting the dirt.

2.2.8. Mulching

Organic mulch is a significant agronomic tool for soil and water conservation to reduce soil erosion and runoff. Researchers have opined that organic mulch conserves soil and water under diverse environmental circumstances (Donjadee & Tingsanchali, 2016; Ngangom et al., 2020; Prem et al., 2020; Prosdocimi et al., 2016; J. Wang et al., 2021) and that increasing the amount of mulch applied reduced soil loss and runoff rates (Rui et al., 2021). Mulching reduces precipitation's volume, intensity, distribution reaching the soil surface, protecting the soil from direct raindrop impact, producing splash and sheet erosion (Misebo, 2018).

Other researchers assert that mulches decrease soil erosion, reduce evaporation, increase infiltration, and inhibit weed development (Asif et al., 2020; Chen et al., 2020; Myburgh, 2013; Ngangom et al., 2020; J. Wang et al., 2021). Mulch might be crop leftovers, pebbles, or plastic sheets. Regardless of the material used, mulching prevents the hard crust from forming after rain, and organic mulches decompose and provide soil nutrients (Fatumah et al., 2021; Rui et al., 2021; Sharma & Bhardwaj, 2017; Shirish et al., 2013). Some researchers observe that mulching can also be used on farmlands along slopes and mountainous regions to conserve soil and water by combating soil erosion, reducing the speed of surface runoff, and increasing water percolation into the soil (H. C. Li et al., 2016). This argument has been endorsed by Wang et al., (2021), who assert that cross-slope cultivation and straw mulching can significantly reduce surface runoff and soil erosion on farmlands along slopes.

2.2.9. Intercropping

Compost or crop residues are used as mulch in conservation agriculture systems. However, competing demands, such as livestock feed during the dry season, usually limit permanent soil cover through crop residue retention; furthermore, termites in tropical environments prevent mulch cover from lasting throughout crop seasons (Mbanyele et al., 2021). With their increased leaf area coverage, intercrops could provide a complimentary 'live' mulch in such environments, particularly during the late stages of crop growth. Intercropping is the simultaneous cultivation of two or more crops in the same field. Intercropping can be done with any crop with main crops as millets and legumes protect against climate change because mixed crop root systems feed at different soil depths (Fantini et al., 2017). Mixing cropping also provides small amounts of grains for home consumption at different times.

Intercropping is a common method of crop intensification in Southern African smallholder farming systems, but it can result in significant crop yield losses or failure due to water competition (Mbanyele et al., 2021). Indeed, intercrops are commonly used on smallholder farms to increase food diversity and reduce the risk of crop failure. These notwithstanding, intercropping outperforms mono-cropping in the sustainable utilization of soil water, nutrients, radiation, and the control of weeds, diseases, and pests (Mbanyele et al., 2021; Wang et al., 2021). Some scholars have established that intercropping staple crops with tap-rooted legumes may be a biological way to improve agricultural production on hardpan soils like pigeon pea create bio pores that maize uses to tap into the subsoil (Fenta et al., 2022; Mbanyele et al., 2021).

2.3. Factors affecting adoption of SWCTs.

Many studies have been conducted to determine SWC adoption factors; however, the adoption rate remains low and undesirable, and little is known as to why farmers choose a particular agricultural technology (Bagheri & Teymouri, 2022). Factors like landholding and land tenure systems, access to capital and labour, household size and structure, training, and awareness might affect the adoption of SWC practices amongst farmers (Kpadonou et al., 2017). The current study reviews some of these factors in this section.

2.3.1. Access to Labour

Changes in inputs and consumer preferences drive the adoption of new technologies. SWCTs such as soil bunds, stone bunds, fanya juu, and artificial rivers may increase production, but their construction and maintenance are labor-intensive (Bagheri & Teymouri, 2022; Pham et al., 2021). Several research works have linked labor availability to SWC adoption (Bagdi et al., 2015; Bagheri & Teymouri, 2022; Enawugaw et al., 2020; Faridi et al., 2020; Fontes, 2020; Giua et al., 2022; Huang et al., 2020; L. Li et al., 2021; Mlenga & Erla, 2019; Pham et al., 2021). Although labor availability influences adoption, however, the influence of SWCT on labor is unknown (Fenta et al., 2022; Fontes, 2020; Tadesse & Belay, 2004; Teshome et al., 2013).

Nevertheless, understanding labor implications is crucial to analysing the full range of repercussions and potential trade-offs. For instance, different types of labor force available may have indirect results. Growing adult labor may impact off-farm activities, whereas decreasing child work may impact educational outcomes. As a result, policymakers must first grasp the labor implications before contemplating potential cross-sectoral ramifications. The cost of labor also has a bearing on whether farmers will adopt or not. Research has established those non-adopters of a technology feared greater adoption costs, such as increased on-farm labor requirements, which could explain this tendency (Fontes, 2020; Tadesse & Belay, 2004; Teshome et al., 2013).

A study carried out in Ethiopia showed that, overall, SWC adoption increased adult and child labor, where the results were significant (Fontes, 2020). The fewer adults available to work means children may have to bear a more significant burden of the added labor demands of the SWC practice (Damtew Atnafe & Maru Ahmed, 2015; Teshome et al., 2013). These results demonstrated negative self-selection. Thus, youngsters are more likely to be burdened by labor-intensive technology. Similarly, there were distinct labor effect patterns among adopters and non-adopters; non-adopters did not adopt technology despite predicted productivity gains (Fontes, 2020). Ther were less reluctant to adopt labor-intensive technology due to their current longer workweeks (Damtew Atnafe & Maru Ahmed, 2015).

2.3.2. Costs and Profitability

The implementation rate of various SWC measures varies significantly from one farmer, region, or country to another. However, profitability appears to be one of the primary economic factors affecting SWC adoption (Teshome et al., 2013). Profitability is a necessary but not sufficient condition for adoption, as other aspects do not lose significance. Reducing soil erosion and improved water and nutrient availability may raise crop yields, but it should also benefit farmers financially. However, this depends on the farming system and ecological, economic, and institutional issues (Misebo, 2018; Tadesse & Belay, 2004).

Further to these costs and profitability also implies analysing the establishment, labour, and maintenance cost requirements of the SWCT to be adopted in any farming venture. On the other hand, benefits from reduced yield decline due to erosion (without investment) and increased yields due to improved water and nutrient efficiency on land saved by the interventions (with the investment) must also be considered. It has been observed that soil erosion causes undesirable off-site impacts like the siltation of reservoirs and streams, which can be termed an extended macro impact on the neighborhoods beyond the farm level. This means that there is a need to consider macro impacts that cascade beyond the farm level, where the SWC is to be implemented in the cost and profitability analysis.

2.3.3. Social demographic factors

Studies have shown that the age of household members affects overall SWC adoption. From years of experience, farmers understand enhanced SWC techniques to reduce soil erosion and add available organic and/or inorganic fertilizer to retain and/or improve soil fertility. Research conducted on slopes in the Ethiopian highlands indicated that household age groups over 45 adopted more physical constructions than those under 44(Fontes, 2020; Teshome et al., 2013). This could be because the most active conservationists were middle-aged farmers who were well established in their farming occupations and still expected to farm for a long time. Thus, older farmers are more likely to manage their land better than younger farmers. Thus, the ability and desire to invest in a farm company relies on a farmer's age. Women have also more likely than men to apply biological soil conservation approaches. This could be because the biological ways of SWC need less labor than physical methods, and biological methods were primarily used at garden and homestead farms. In contrast, male household heads mostly used physical methods.

In addition to these socio-economic factors, family size affects labor supply and subsistence needs. This is due to rising food crop demand and limited land resources. Having a big family with little resources may cause land degradation, affecting farmers' ability to boost land production from fragmented plots. Less than half of the households in the US use conservation structures (physical conservation structures) (de Graaff et al., 2013). That's because physical conservation techniques need more labor than other conservation methods. Household size has been shown to harm soil conservation practices. However, in some studies, the family size variable had positive correlations, indicating that larger households provided more labor for conservation (Damtew Atnafe & Maru Ahmed, 2015; Mugonola et al., 2013; Tiwari et al., 2008).

2.3.4. Land tenure systems

Land plays a significant role in agricultural output. Larger farms are likely to embrace more SWC methods because they have more discretionary resources, more chances to test new practices, and manage risk (de Graaff et al., 2013; Nugroho et al., 2022). In addition, SWC, especially physical conservation structures, rely on the slope of farmer plots (Damtew Atnafe & Maru Ahmed, 2015). Many studies worldwide show that lack of resource control is one of the critical causes of resource deterioration (Bagheri & Teymouri, 2022; de Graaff et al., 2013; Giua et al., 2022; L. Li et al., 2021; Mugonola et al., 2013; Nugroho et al., 2022; Pham et al., 2021). In essence, whether communal, private freehold, or leased, the land tenure system significantly affects the adoption and implementation of SWCTs.

When farmers own their land, they have a legal right to use it. The security of tenure impacts how much farmers can profit from land improvements. The risk of losing the right makes them less likely to invest or conserve the land's productive capability. With only a few seasons to retain land, farmers have no incentive to invest; their motivation is to get the most out of it, even if it reduces the land's future productivity. Studies on the effect of tenure on innovation adoption have usually concluded that farm renters are less inclined to invest in soil conservation techniques due to a lack of commitment to long-term soil productivity (Damtew Atnafe & Maru Ahmed, 2015).

2.3.5. Physical factors

A slope indicates the likelihood of erosion. Therefore, the slope of a plot influenced the adoption of conservation structures, as steeper slopes are more prone to erosion. Thus, steeper slopes are more prone to developing physical structures. Most farm plots in Ethiopia were on gentle to steep slopes prone to erosion (Mekuriaw et al., 2018). In China, Chen et al. (2020); Donjadee & Tingsanchali, (2016); and Wang et al. (2021) assert that the slope of a plot is one of the elements impacting soil conservation. Their findings show that farmers with steeper fields are more the SWc practices to be adopted by farmers. Sharply sloped plots yield low returns on investment, resulting in lower adoption. A finding endorsed by Damtew Atnafe & Maru Ahmed (2015) is that the slope of a plot influenced farmers' adoption of soil conservation practices favorably and considerably.

Low potential areas have higher adoption rates than high agricultural potential areas. This disparity is because there are usually substantial governmental involvement and technical and financial support in the low-potential areas (Belachew et al., 2020; Mekuriaw et al., 2018). Hence, the farmers there have a better understanding of the multiple uses of physical SWC structures than farmers in the high-potential areas.

2.3.6. Access to information and awareness

Farmers' education has also been considered to improve their ability to receive and utilize agricultural information and technology. Studies showed that fertilizers and composting, soil conservation techniques, planting trees and fences, increased access to information, and managerial experience benefited from improved education (Bastia et al., 2021; Mugonola et al., 2013). Because institutional and socio-economic factors impact and hinder investments in SWC practices. On the other hand, visits to demonstration fields, formal or informal training, television viewing, and contacting extension or development agents can provide information about new technology (Belachew et al., 2020; Mekuriaw et al., 2018; Mugonola et al., 2013; Pham et al., 2021; Tadesse & Belay, 2004). Many activities such as training visits, field days, and demonstration trials as avenues to effectively promote new agricultural technologies. Agricultural extension is critical to improving smallholder farmer productivity in most developing and least developed countries where traditional farming practices predominate. Agri-extension is provided in most agriculture potential areas by the agriculture ministries and its technical experts and primarily concentrates on fundamental agricultural education, teaching, and demonstrating agricultural inputs, forestry, soil conservation, and livestock production (Mekuriaw et al., 2018; Mlenga & Erla, 2019; Mugonola et al., 2013).

As farmers become more knowledgeable about new technologies, their attitudes toward adoption may change, influencing the pace of technological transfer. There is a positive and significant bivariate association between contact with development agents and the adoption of soil conservation practices (Damtew Atnafe & Maru Ahmed, 2015). A surprisingly high number of people have seen demonstrations of physical constructions (mostly fanya juu), as well as soil management (compost) (Damtew Atnafe & Maru Ahmed, 2015; Mekuriaw et al., 2018). These studies further observed that visiting demonstrations and implementing SWC methods significantly and the presence of good demonstration sites can enhance higher rates of SWC adoption. In addition, a training background in agriculture and its related professional fields and efforts by extension services to distribute innovative agricultural technology and information help people embrace them (Damtew Atnafe & Maru Ahmed, 2015).

3. METHODOLOGY

3.1 Study area

Mount Elgon is a massive solitary volcanic mountain on the border of eastern Uganda and western Kenya. Its vast form, eighty kilometers in diameter, rises 3070m above the surrounding plains, greatly determining the climate of the area and equally providing a refuge for flora and fauna. Mount Elgon has been a regional landmark for a long time: this extinct volcano is one of Uganda's oldest physical features, first erupting around 20 million years ago. It was once Africa's highest mountain, towering above even Kilimanjaro's 5895m. However, millennia of erosion and landslides have reduced its height to 4321m, relegating it to the 22nd highest peak in East Africa and 7th on the continent (Uganda Wildlife Authority, 2022). However, its 4000km2 surface area is still the largest base of any volcanic mountain worldwide. Mount Elgon is a hugely important water catchment. Its forests receive up to 3000mm of rain each year, which they store and release to support flora, fauna and more than a million Ugandans. Therefore, soil and water conservation on the slopes of Mt Elgon is key and requires the necessary attention given the various functions it provides to its inhabitants (Makosya, 2021).

The climate area's is primarily tropical humid, with a mean annual rainfall of 1400–1800 mm and an average temperature of 14–24°C, though both these parameters vary drastically with elevation. Long rains happen between March and June, and short rains fall between September and November, forming a bimodal annual rainfall pattern. From June through September, the average temperature is at its lowest. With increasing altitude, potential evapotranspiration reduces (Githui et al., 2009). Clay, as well as loamy and sandy soil types, are found in the area.

The area is characterized by heavy agricultural activity, woodland, and a considerable presence of shrub land in terms of land use. Protected afro-montane woods dominate the upper reaches of Mt. Elgon. In general, the area's altitude lies within a range of 1200 m to 2900 m above sea level. Luvisols, feralsols, nitosols, and leptosols are the most common soil types in the area. Much of the area is used for agriculture. The most common crops are a combination of coffee and bananas and a variety of horticultural crops (onions, cabbages, and tomatoes) cultivated on annual crop lands (Makosya, 2021; UBoS, 2020). The coordinates of the study area are 1°04'50.0"N, 34°14'53.0"E (Latitude: 1.080556; Longitude: 34.248056) (Figure 1 below)**.**

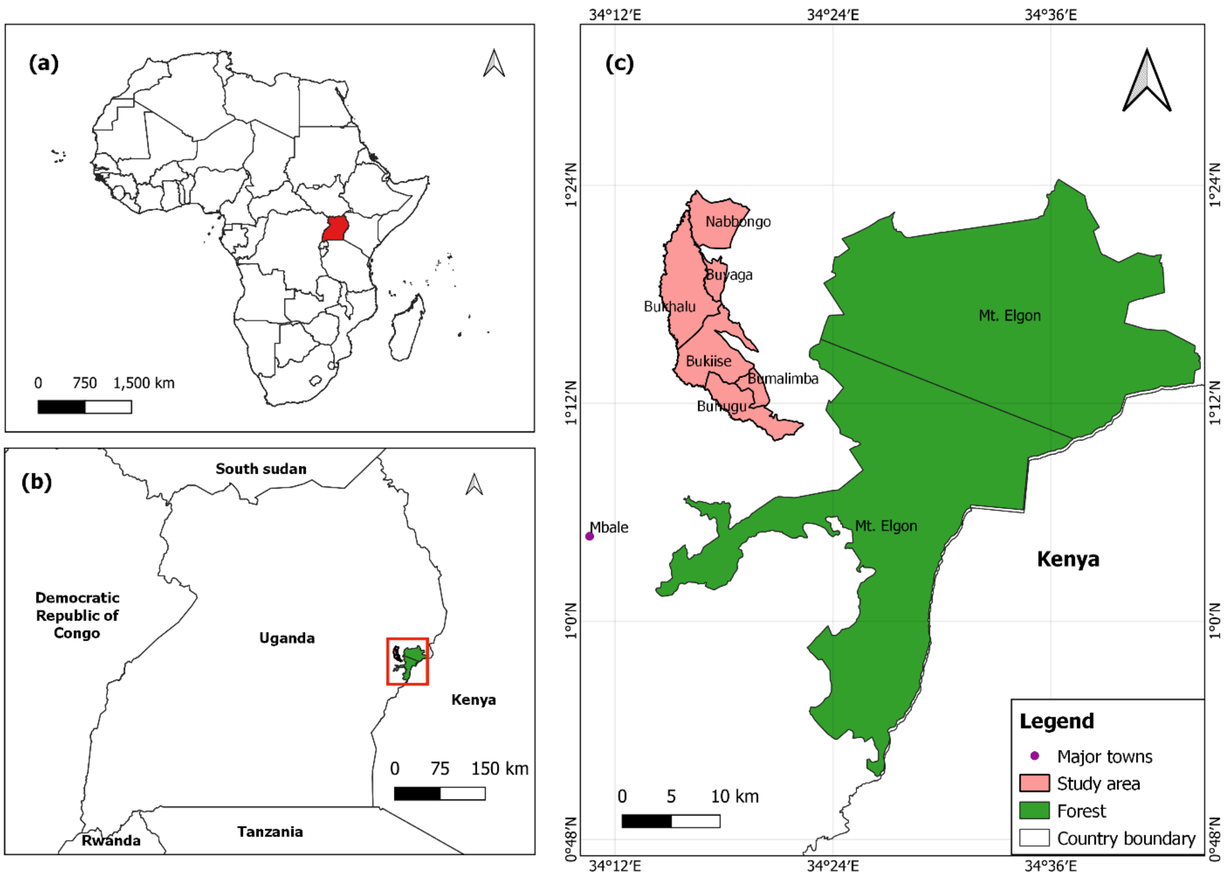


Figure 3.1: Map of the study area: a) Location of Uganda in Africa b) Location of the study area in Uganda c) Map of the study area showing the sampled sub counties.

3.2 Research design

This study used a combination of research methods, known as mixed research methods, with a focus on concurrent or parallel methods. The quantitative research method was utilized to gather information on the measurable relationships between the adoption of SWC practices and various factors such as household characteristics, socio-economic conditions, institutional factors, and physical factors. On the other hand, the qualitative research method was used to collect and analyze non-numerical data that complemented and enhanced the quantitative research findings.

3.3 Target population

Community members living in and within a radius of 10km from Mt Elgon from the selected sub-counties formed the target population as they are presumed to be the most affected by landslides, soil erosion and land degradation (NEMA-Uganda, 2019) . Six sub-counties, including Bukhalu, Buyaga, and Nabbongo, from Bulambuli district and Bukiise, Buhugu, and Bumalimba, from Sironko district were selected for the study. These sub-counties lie on the steep slopes of the Mt Elgon region, which are prone to erosion, landslides, and general land degradation(NEMA-Uganda, 2019).

According to the Uganda Bureau of Statistics (UBoS) (2021), Bukhalu Subcounty has a population of 4,869 households, Buyaga Subcounty has 16,375 households, Nabbongo Sub county has 2,062, Bukiise Sub county has 4,720 households, Buhugu Sub county has a 1,826, and Bumalimba Sub county has a population of 3,930 households making a total of 33,782 which is the target population (Table 1 below). The sample size was calculated from the target population of households as shown in table 3.1

Table 3.1: Study Population and Sample Size Determination

Item No.	**Sub-county**	**Target population**	**Number of Households**	**Sampling type and rule**	**Proportionate Households Sample**
1	Bukhalu	28,044	4,869	• Proportionate • Simple random	20
2	Buyaga	83,945	16,375	• Proportionate • Simple random	67
3	Nabbongo	9,582	2,062	• Proportionate • Simple random	9
4	Bukiise	20,538	4,720	• Proportionate • Simple random	19
5	Buhugu	7,432	1,826	• Proportionate • Simple random	8
6	Bumalimba	16,910	3,930	• Proportionate • Simple random	16
	Total	166,451	33,782	**Total**	139

(Sources: UBoS, 2021; Researcher, 2022)

3.4 Sampling Frame, Sample Size, and Sampling Procedures

The study enlisted households as the sampling frame for each village in the study sites. And the selected six sub-counties, including Bukhalu, Buyaga, Nabbongo, Bukiise, Buhugu, and Bumalimba, from the two districts of Bulambuli and Sironko, having a total of 33,782 households (Table 1 above). From this population about 90% of households participate in agriculture (UBoS, 2020). The sample size was determined by the formula,

$n = z^2 \frac{(p\ x\ q)}{d^2}$ (Wanjohi et al., 2020)

Whereby: *n* = the desired minimum sample size, *z* = the standard normal deviation at set confidence interval, *d* = the acceptable range of error (0.05), *p* = the proportion of households participating in agriculture (90%) and *q* = the proportion of households that does not participate in agriculture= 1-*p* (10%). Hence; *d* = 0.05, *p* = 0.9, *z* = 1.96 at 95% confidence level, *q* = 0.1.

$$\text{Thus } n = 1.96^2 \frac{(0.9\ x\ 0.1)}{0.05^2} = 139$$

Therefore, the minimum sample size was 139 household heads (HH) from each household.

On the other hand, proportionate sampling was used to enlist the number of respondent households per sub-county along the slopes of the Mt Elgon region, with simple random sampling used to recruit a respondent from each household. Proportionate sampling enabled the equal representation of the sub-counties in the sampling frame with simple random sampling giving equal opportunity for the entire households in the study population.

3.5. Data collection tools

To collect data for the study, various methods were utilized, including field observations and the administration of questionnaires. The questionnaires were mainly focused on SWCTs, as well as socio-demographic factors related to their implementation, and factors influencing their adoption. The design of the questionnaire was reviewed by the supervisor and other scholars to ensure its validity. Before administering the questionnaire in the field, a pilot study was conducted to identify and eliminate any ambiguities in the data collection tool. The questionnaires were administered to households by research assistants, while semi-structured questionnaires were used to collect data from extension officers, water officers, and representatives of NGO and CBOs who work with farmers on soil and water conservation in the two districts Bulambuli and sironko. From each organization, 3 respondents were selected making a total of 12.

3.6 Data Analysis and presentation

Data from Household Questionnaire Surveys was collated, coded, and entered into Statistical Package for Social Sciences (SPSS) version 27 software for analysis. Descriptive statistics was used to analyse data to answer the research objectives. The binary logistic regression model in testing objective 3. The results were presented in graphs and tables.

4.0. RESULTS AND DISCUSSION

4.1. Introduction

This chapter details the presentation and interpretation of the findings of the study. The findings are based on the responses from the questionnaires filled out and the information gathered on the research questions. The research findings were presented in the form of pie charts, frequency distribution tables, and narrations. The researcher used SPSS version 27 to analyze the data collected. The results and findings of the study on the subject under investigation are presented and interpreted in this chapter.

The analysis was guided by the following research objectives:

iv. To find out the SWCTs practiced by farmers along the slopes of Mt Elgon

v. To find out the factors influencing the adoption of SWCTs by farmers along the slopes of Mt Elgon

vi. To establish the significance of the relationship between SWCTs implemented and the factors influencing their adoption along the slopes of Mt Elgon

4.2 Response Rate

As already indicated in Chapter 3, the study employed a quantitative approach and a cross-chapter research design to collect data. Since a quantitative approach using survey design was employed.

Table 4.1: Response rate for study participants from the field

Category	Frequency	Percentage
Responded	139	100%
Not Responded	0	0%
Total	139	100%

Source: Primary Data. Survey 2023 n=139

The 100% response rate was generated because of the following reasons:

1. The researcher used personalized questionnaires that addressed the respondents by their positions and included a personalized message, which helped establish a connection with the respondent and encourage them to participate.
2. Secondly, the researcher prepared Clear and concise questions make it easier for participants to understand what is being asked and provide accurate responses.
3. The researcher kept on sending multiple reminders to participants and encouraging them to complete it.
4. The researcher selected an appropriate time to send out the survey, such as during business hours or when participants are likely to be free, which helped increase response rates.

Therefore, the response rate in this study was considered relatively better than the previous studies mentioned above. Therefore, the above response rate results are in line with Amin's (2007) argument that a response rate >= 50 is good enough to be representative of a survey population.

4.3 **Demographic characteristics of the survey study.**

The demographic characteristics of the questionnaire survey included sub county, age, gender, source of income, farm size among others as shown in the tables below.

4.3.1. Sub-county

Table 4.2: showing Sub-county

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bukhalu	20	14.4	14.4	14.4
	Buyaga	67	48.2	48.2	62.6
	Nabbongo	9	6.5	6.5	69.1
	Bukiise	19	13.7	13.7	82.7
	Buhugu	8	5.8	5.8	88.5
	Bumalimba	16	11.5	11.5	100.0
	Total	139	100.0	100.0	

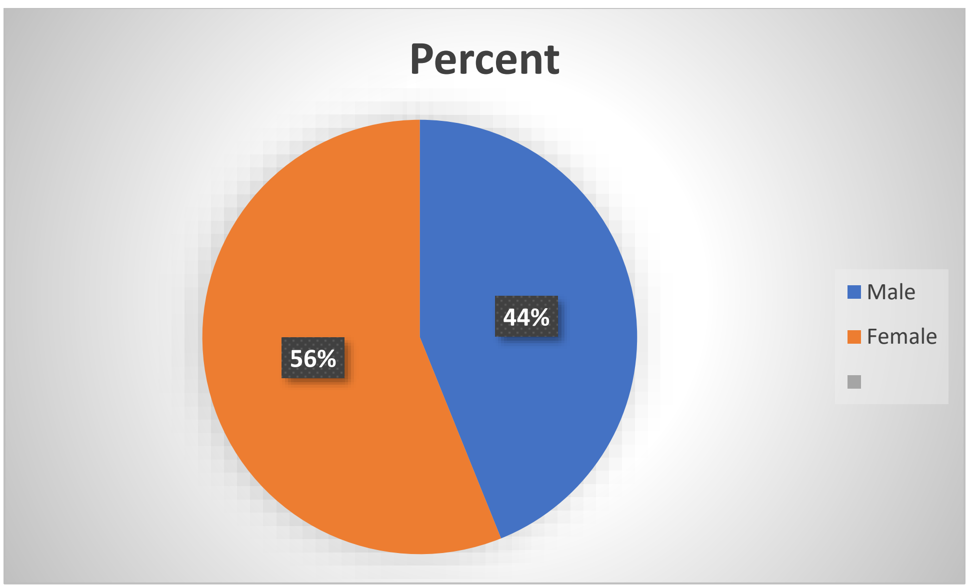
Primary data (2023) n=139

The table presents the frequency and percentage distribution of the sub counties where respondents reside and carry out farming activities in the selected Mount Elgon region of Uganda. The data were collected as part of an analysis of the adoption of soil and water conservation technologies in the area.

Out of the 139 respondents, the majority (48.2%) resided in Buyaga Sub County, followed by Bukhalu (14.4%), Bukiise (13.7%), Bumalimba (11.5%), Nabbongo (6.5%), and Buhugu (5.8%). These findings suggest that Buyaga sub county has the highest number of farmers in the study area. The information could be useful for policymakers and agricultural extension workers to target interventions and promote the adoption of soil and water conservation technologies in the region. Additionally, the data could be used for further analysis to explore the factors influencing the adoption of these technologies in each sub county.

4.3.2. Gender

Figure 3.2: Gender



Primary data (2023) n=139

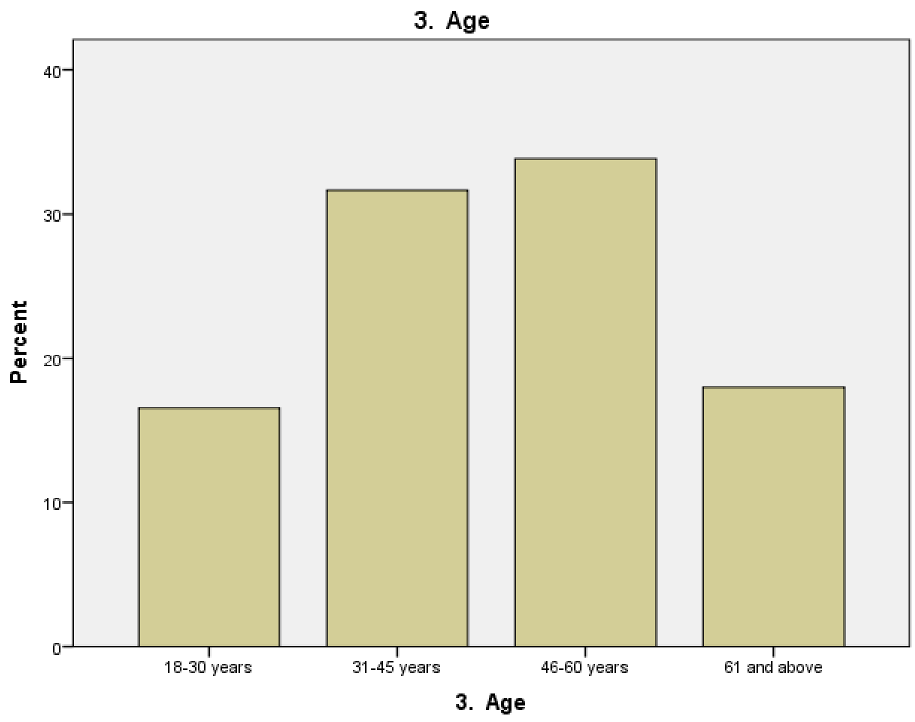
The table shows the frequency and percentage distribution of gender among the 139 respondents in the study area. The observed gender distribution of the respondents in the study, with a majority of females (56.1%) and a minority of males (43.9%), is explained by the sampling strategy or recruitment methods used in the study unintentionally led to a higher participation rate among women. For instance, the researcher used random sampling method, such as approaching households during the day when women were more likely to be at home, which resulted in a higher proportion of female respondents.

The questionnaires were administered to all household members involved in farming activities.

These findings suggest that there is a relatively higher number of female farmers in the study area. This information could be used to design and implement gender-sensitive interventions aimed at promoting the adoption of soil and water conservation technologies in the region. Gender is an important factor that influences the adoption of agricultural technologies, and understanding the gender dynamics in the adoption process is critical for effective intervention design and implementation. The data in this table could be used in further analysis to explore the gender-based differences in the adoption of soil and water conservation technologies in the study area.

4.3.3: Age

Figure 3.3: Age



Primary data (2023) n=139

The table presents the frequency and percentage distribution of age among the 139 respondents in the study area. The data are categorized into four age groups: 18-30 years, 31-45 years, 46-60 years, and 61 and above.

The largest group of respondents (33.8%) fell within the age range of 46-60 years, followed by 31-45 years (31.7%), 61 and above (18.0%), and 18-30 years (16.5%). These findings suggest that the majority of farmers in the study area are between the ages of 31 and 60 years. This information could be useful for designing interventions that target specific age groups to promote the adoption of soil and water conservation technologies. For instance, older farmers might require different intervention strategies than younger farmers, who might be more receptive to new technologies.

Additionally, the data in this table could be used for further analysis to explore the relationship between age and the adoption of soil and water conservation technologies in the study area. Understanding the factors that influence technology adoption among different age groups could help design more effective interventions to promote sustainable agriculture in the region.

4.3.5. Level of education

Table 4.3: showing Level of education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	University	8	5.8	5.8	5.8
	College	20	14.4	14.4	20.2
	Secondary level	27	19.4	19.4	39.6
	Primary level	4	2.9	2.9	42.5
	No Education	80	57.6	57.6	100.
	Total	139	100.0	100.0	

Primary data (2023) n=139

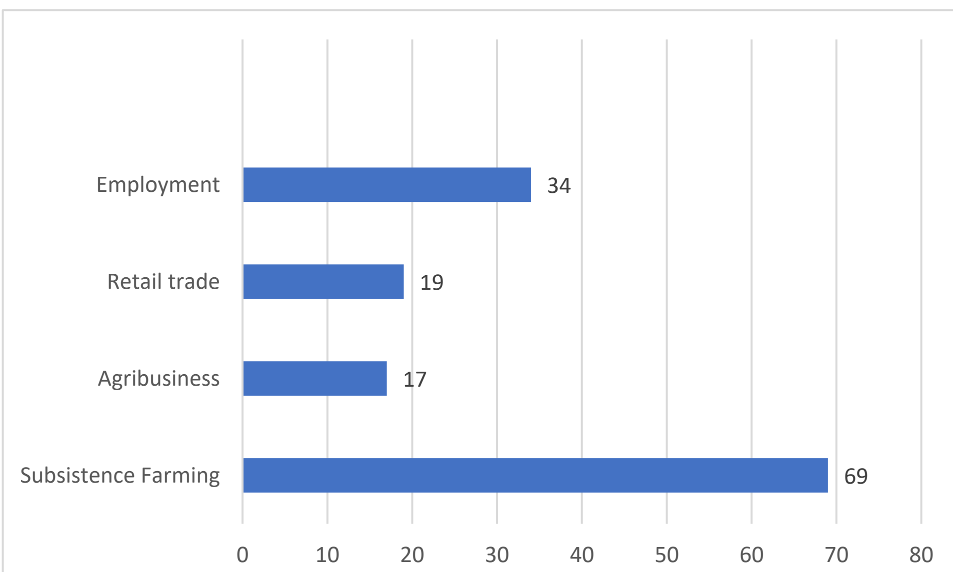
The table presents the frequency and percentage distribution of the level of education among the 139 respondents in the study area. The data are categorized into four education levels: university, college, secondary level, primary level and no education

Based on the information in Table 4.3, findings note that out of the 139 participants surveyed in the study on the adoption of soil and water conservation technologies in selected sub-counties of Mount Elgon Region in Uganda, the majority of the participants (57.6%) did not have any formal education. The second largest group of participants had completed their education at the secondary level (19.4%), followed by those who had completed college (14.4%) and university education (5.8%). Only a small percentage of participants (2.9%) had completed education at the primary level.This finding has important implications for the adoption of soil and water conservation technologies in the region. The results suggest that efforts to promote and encourage the adoption of such technologies may need to take into account the low levels of education among the majority of the population. Effective communication strategies and appropriate education and training programs may need to be developed to ensure that the benefits of soil and water conservation technologies are effectively communicated to those who may have limited formal education.

Moreover, the results also suggest that interventions that target households with no education and primary level education should be given priority as they are the ones who might be more difficult to reach with interventions that require some level of education. Similarly, interventions should be customized to address the specific needs and contexts of different education levels in the region to achieve a more effective adoption of soil and water conservation technologies.

4.3.6: Occupation

Figure 3.4: Showing Occupation



Primary data (2023) n=139

The table shows the frequency and percentage distribution of occupation among the 139 respondents in the study area. The data are categorized into four groups: subsistence farming, agribusiness, retail trade, and employment.

The largest group of respondents (49.6%) reported subsistence farming as their occupation, followed by employment (24.5%), retail trade (13.7%), and agribusiness (12.2%).

These findings suggest that subsistence farming is the dominant occupation in the study area. This information could be useful for designing interventions that specifically target subsistence farmers to promote the adoption of soil and water conservation technologies. For instance, interventions could be designed to improve access to resources such as improved seed varieties, fertilizer, and extension services.

The data in this table could also be used for further analysis to explore the relationship between occupation and the adoption of soil and water conservation technologies in the study area. Understanding the factors that influence technology adoption among different occupational groups could help design more effective interventions to promote sustainable agriculture in the region.

4.3.7: Household Size

Table 4.4: showing Household size.

6. Household size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	5	3.6	3.6	3.6
	2	33	23.7	23.7	27.3
	3	11	7.9	7.9	35.3
	4	43	30.9	30.9	66.2
	5	12	8.6	8.6	74.8
	6	8	5.8	5.8	80.6
	7	27	19.4	19.4	100.0
	Total	139	100.0	100.0	

Primary data (2023) n=139

The household size data provided in the frequency table is relevant to the analysis of the adoption of soil and water conservation technologies in the selected sub-counties of Mount Elgon region, Uganda. Household size is an important factor that can influence the adoption of these technologies because larger households may require more resources and may face different constraints compared to smaller households.

To calculate the mean household size using the provided frequency table, you need to multiply each household size by its corresponding frequency, sum the products, and then divide by the total number of households.

Here is the calculation:

(1 x 5) + (2 x 33) + (3 x 11) + (4 x 43) + (5 x 12) + (6 x 8) + (7 x 27) = 512

Mean household size = 512 / 139 = 3.68

Therefore, the mean household size is 3.68.

The data shows that the majority of households in the sample have a size of 4 or less, representing 66.2% of the sample. This suggests that smaller households are more common in the selected sub-counties of Mount Elgon region, which could have implications for the adoption of soil and water conservation technologies. Smaller households may be more able to adopt these technologies due to lower resource requirements and less complex decision-making processes.

However, it is also worth noting that a significant proportion of households in the sample (19.4%) have a size of 7, which is the largest household size in the sample. These households may face different challenges in adopting soil and water conservation technologies compared to smaller households. For example, they may require more resources to implement the technologies and may face more complex decision-making processes due to the larger number of household members.

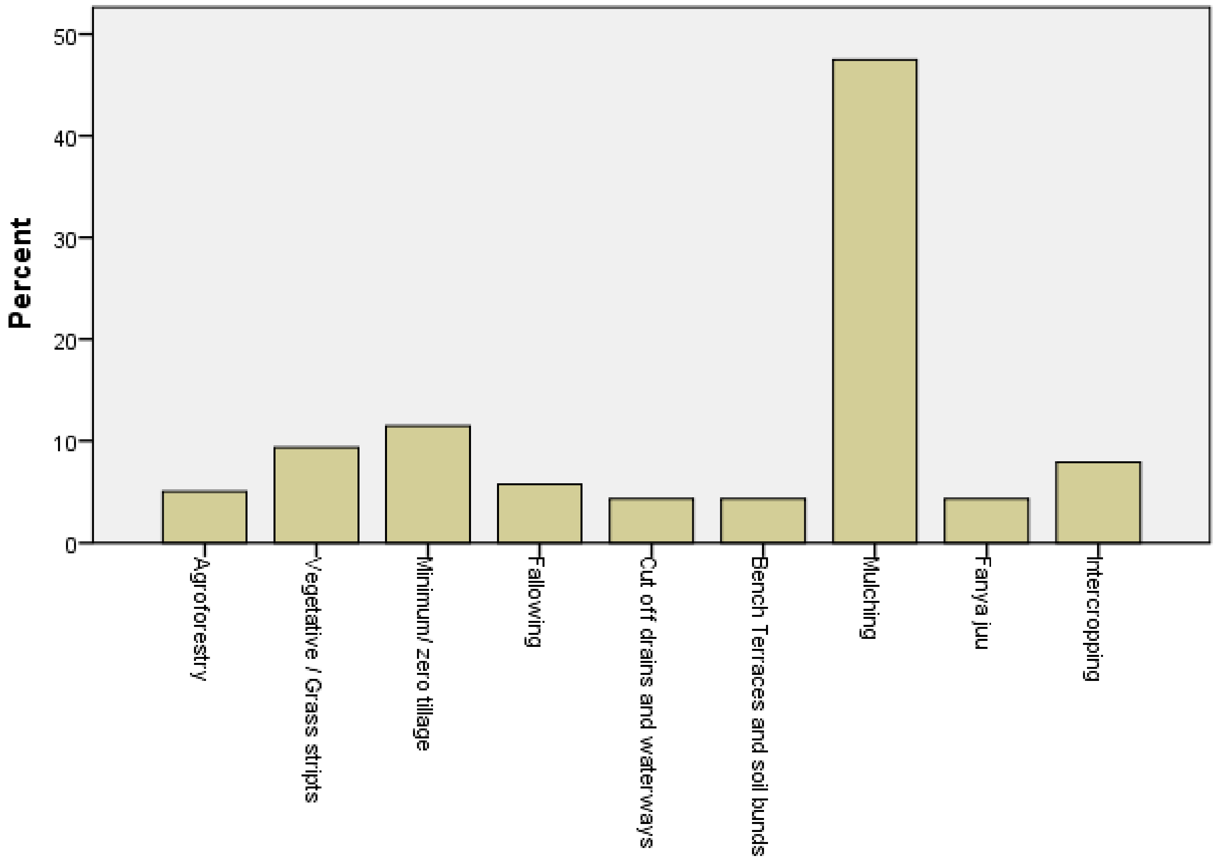
Overall, household size is an important factor to consider when analysing the adoption of soil and water conservation technologies in the selected sub-counties of Mount Elgon region, Uganda. The data provided in the frequency table suggests that smaller households are more common, but a significant proportion of households are also relatively large, which may have implications for the adoption of these technologies.

4.4.Descriptive statistics

4.4.The SWCTs practiced by farmers along the slopes of Mt Elgon

4.4.1. SWCTs practiced by farmers

Figure 3.5: Showing SWCTs practiced by farmers



Primary data (2023) n=139

The figure shows the number and percentage of respondents who reported using different types of Soil and Water Conservation Technologies (SWCTs) along the slopes of Mount Elgon in Uganda. The most commonly used SWCT was mulching, with 66 respondents (47.5%) reporting its use. This was followed by minimum/zero tillage, vegetative/grass strips, and intercropping. Bench terraces and soil bunds were also commonly used by 6 respondents (4.3%). Fallowing and agroforestry were reported by fewer respondents, while Fanya juu, cut off drains, and waterways were the least commonly reported SWCTs, each being used by only 6 respondents (4.3%). The findings suggest that mulching and minimum/zero tillage are popular SWCTs among farmers in this region, possibly because they are relatively easy to implement and can have multiple benefits such as improving soil fertility and reducing erosion.

4.4.2. SWCTs implemented by farmers

Table 4.5: SWCTs implemented by farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Monthly	12	8.6	8.6	8.6
	Once every year	105	75.5	75.5	84.2
	Once 2-3 months	19	13.7	13.7	97.8
	Once every two years	3	2.2	2.2	100.0
	Total	139	100.0	100.0	

Primary data (2023) n=139

From the data, we can see that most farmers in the selected sub-counties of Mount Elgon region, Uganda implement SWCTs once every year (75.5%). Some farmers implement SWCTs more frequently, with 8.6% implementing them monthly and 13.7% implementing them once every 2-3 months. Only a small percentage of farmers (2.2%) implement SWCTs once every two years. This suggests that there is a relatively high level of awareness and adoption of SWCTs among farmers in the area, and that they are implementing them with some regularity. However, there may still be opportunities to encourage more frequent implementation of these practices in order to maximize their effectiveness in conserving soil and water resources.

4.4.3. Common **soil and water management challenges faced by farmers**

Table 4.6: common soil and water management challenges faced by farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Soil Erosion	2	1.4	1.4	1.4
	Reduced Water retention	11	7.9	7.9	9.4
	Mud slides/ Debris flow	107	77.0	77.0	86.4
	Reduced soil humus	11	7.9	7.9	94.3
	Reduced soil fertility	7	5.0	5.0	99.3
	Others	1	.7	.7	100.0
	Total	139	100.0	100.0	

Primary data (2023) n=139

1. Mud slides/Debris flow: This was reported as the most common soil and water management challenge faced by farmers in the region, with a frequency of 107 (77.0%). This is not surprising given the mountainous terrain of the area, which is prone to erosion and landslides. Mud slides and debris flow can cause extensive damage to crops and infrastructure, and also pose a risk to human life.
2. Reduced Water retention: This was reported by 11 respondents (7.9%). Water retention is a critical aspect of soil and water management, especially in areas where rainfall is limited or erratic. Reduced water retention can lead to drought stress in crops and reduce agricultural productivity.
3. Reduced soil humus: This was reported by 11 respondents (7.9%). Soil humus is the organic component of soil, and plays a vital role in maintaining soil fertility and structure. Reduced soil humus can lead to soil degradation and reduced crop yields.
4. Reduced soil fertility: This was reported by 7 respondents (5.0%). Soil fertility is another critical aspect of soil and water management, and refers to the ability of soil to provide

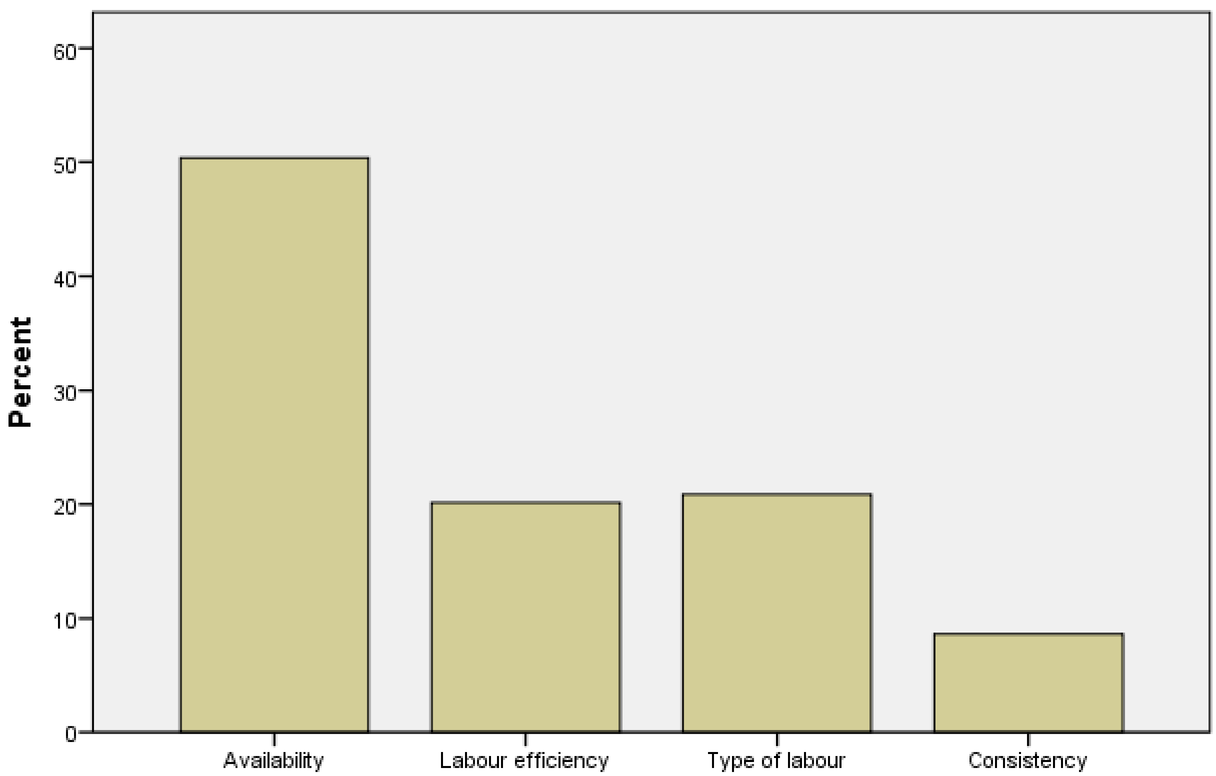
essential nutrients to plants. Reduced soil fertility can lead to poor crop growth and reduced yields.

5. Soil erosion: This was reported by only 2 respondents (1.4%). Soil erosion is a significant challenge in many agricultural areas, and can lead to the loss of topsoil, reduced soil fertility, and increased sedimentation in water bodies.
6. Others: One respondent (0.7%) reported other soil and water management challenges that were not specified in the survey.

4.5. **Factors that influence the adoption of SWCTs**

4.5.1. Factors that influence the adoption of SWCTs

Figure 3.6: Showing Factors that influence the adoption of SWCTs



Primary data (2023) n=139

The findings of the analysis of the adoption of SWCTs in selected sub-counties of Mount Elgon region in Uganda suggest that labour-related factors are important considerations for the adoption of SWCTs.

Among the labour-related factors, availability of labour was identified as the most influential factor, with 50.4% of respondents indicating its importance. This suggests that farmers are more likely to adopt SWCTs if there is sufficient and reliable labour available for implementation. This finding highlights the need for interventions that can increase the availability of labour for SWCT implementation, such as training programs that can help to develop the necessary skills and knowledge among farmers and other stakeholders.

Labour efficiency was also found to be an important factor influencing the adoption of SWCTs, with 20.1% of respondents indicating its significance. This suggests that farmers are more likely to adopt SWCTs if they can achieve the desired outcomes with minimal labour inputs. This finding highlights the need for interventions that can help to improve the efficiency of SWCT implementation, such as the use of appropriate technologies and practices that can help to reduce labour requirements.

Finally, type of labour was identified as another important factor influencing the adoption of SWCTs, with 20.9% of respondents indicating its importance. This suggests that farmers are more likely to adopt SWCTs if they have access to the right type of labour for implementation. This finding highlights the need for interventions that can help to match the right type of labour to the specific SWCT practices, such as the use of specialized labour for more complex SWCT practices.

Overall, the findings of the analysis suggest that labour-related factors are important considerations for the adoption of SWCTs, and that interventions aimed at increasing the availability, efficiency, and type of labour can help to promote the adoption of SWCTs in the Mount Elgon region of Uganda.

Mugisha et al., (2017) found that availability of labour was the most influential factor, followed by labour efficiency and type of labour. The study also highlighted the need for interventions that can increase the availability of labour for SWCT implementation, such as training programs and improved access to markets for non-farm labour. Additionally, the study emphasized the importance of improving the efficiency of SWCT implementation using appropriate technologies and practices that can help to reduce labour requirements.

4.5.2. The costs and profitability factors that influence adoption of SWCTs

Table 4.7: Showing costs and profitability factors that influence adoption of SWCTs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Production costs	99	71.2	71.2	71.2
	Cost of SWCT inputs	16	11.5	11.5	82.7
	Productivity and profits	14	10.1	10.1	92.8
	Alternative income potentials	10	7.2	7.2	100.0
	Total	139	100.0	100.0	

Primary data (2023) n=139

The findings of the analysis of the adoption of SWCTs in selected sub-counties of Mount Elgon region in Uganda suggest that costs and profitability factors are important considerations for the adoption of SWCTs.

Among the costs and profitability factors, production costs were identified as the most influential factor, with 71.2% of respondents indicating its importance. This suggests that farmers are more likely to adopt SWCTs if the production costs associated with their implementation are manageable and do not exceed the expected benefits. This finding highlights the need for interventions that can help to reduce the production costs of SWCTs, such as the promotion of cost-effective SWCT practices and the provision of subsidies or other forms of financial support.

The cost of SWCT inputs was also found to be an important factor influencing the adoption of SWCTs, with 11.5% of respondents indicating its significance. This suggests that farmers are more likely to adopt SWCTs if the cost of inputs required for their implementation, such as seeds, fertilizers, and other materials, is reasonable and affordable. This finding highlights the need for interventions that can help to reduce the cost of SWCT inputs, such as the promotion of local production and distribution of inputs.

Productivity and profits were identified as another important factor influencing the adoption of SWCTs, with 10.1% of respondents indicating its importance. This suggests that farmers are more likely to adopt SWCTs if they can increase their productivity and profits through the implementation of these practices. The findings of the analysis on the adoption of SWCTs in selected sub-counties of Mount Elgon region in Uganda are supported by a study by Tumuhimbise et al. (2018), which found that production costs and profitability are important considerations for farmers in the adoption of SWCTs. The study also found that the cost of inputs, productivity, and profits are significant factors that influence the adoption of SWCTs among farmers in the region.

4.5.3. **The social demographic factors influence the adoption of SWCTs**

Table 4.8: Showing social demographic factors influence the adoption of SWCTs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Size of household/ defendants	13	9.4	9.4	9.4
	Education level	4	2.9	2.9	12.2
	Neighbouring armed relations	24	17.3	17.3	29.5
	Main income sources	12	8.6	8.6	38.1
	Gender of household head	3	2.2	2.2	40.3
	Availability of household labour	36	25.9	25.9	66.2
	Farmer group membership	39	28.1	28.1	94.2
	other factors	8	5.8	5.8	100.0
	Total	139	100.0	100.0	

Primary data (2023) n=139

The findings of the analysis suggest that social demographic factors have a significant impact on the adoption of Soil and Water Conservation Technologies (SWCTs) in the selected sub-counties of Mount Elgon region, Uganda. Among the factors identified, the three most influential factors are neighbouring farmer relations, availability of household labour, and farmer group membership. The high percentage of farmer group membership (28.1%) suggests that joining farmer groups or associations can be an effective way to promote the adoption of SWCTs among farmers in the study area. These groups may provide support, information, and training on SWCTs, as well as create a sense of community and shared responsibility for conservation efforts.

The availability of household labour (25.9%) is another crucial factor that impacts the adoption of SWCTs. This suggests that interventions that aim to increase labour availability, such as providing labour-saving technologies or encouraging the participation of women and children in conservation efforts, could promote the adoption of SWCTs.

The significant influence of neighbouring farmer relations (17.3%) indicates that social networks and peer pressure may play a role in the adoption of SWCTs. Interventions that aim to leverage social influence, such as farmer-to-farmer extension programs, could help to promote the adoption of SWCTs among farmers in the study area.

The findings of the analysis are supported by the study conducted by Kiwara et al. (2015), which also found that social demographic factors play a significant role in the adoption of SWCTs among farmers in Tanzania. The study found that social factors such as group membership, social networks, and peer pressure were important determinants of SWCT adoption. Additionally, the study found that labour availability and access to credit were important factors influencing SWCT adoption.

4.5.4. **The common land tenure systems along the slopes of Mt Elgon**

Table 4.9: The common land tenure systems along the slopes of Mt Elgon

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Leased land	40	28.8	28.8	28.8
	communal ownership	48	34.5	34.5	63.3
	private owned	47	33.8	33.8	97.1
	Others	4	2.9	2.9	100.0
	Total	139	100.0	100.0	

Primary data (2023) n=139

The findings indicate that there are three common land tenure systems along the slopes of Mt Elgon: leased land (28.8%), communal ownership (34.5%), and private ownership (33.8%). The most prevalent system is communal ownership, which is owned and managed by a community or group of individuals. Private ownership is also relatively common, with individuals or families holding exclusive rights to use, manage, and dispose of the land. Leased land is the least common, with individuals or groups renting the land from the owners for a specified period. Finally, there are also some other tenure systems (2.9%), which are not specified in the data. These findings are important for understanding the local context and for designing appropriate interventions that take into account the existing land tenure systems. Among these, communal ownership is the most widespread, with ownership and management shared among a community or group of individuals, while private ownership is also prevalent, with individuals or families holding exclusive rights to use, manage, and dispose of the land (Mwesigye et al., 2020).

4.4.5: land tenure systems influence the adoption of SWCTs

Table 4.10: land tenure systems influence the adoption of SWCTs

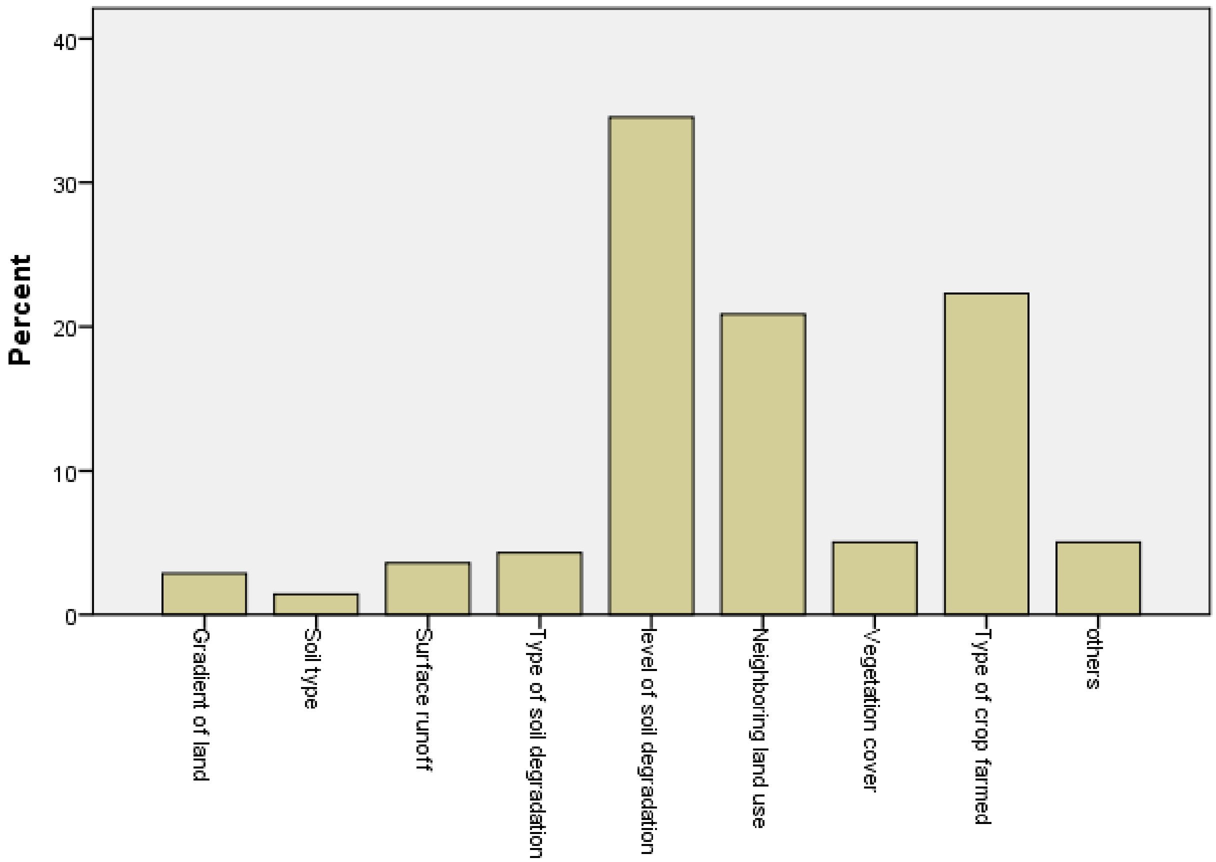
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Choice of SWCT	18	12.9	12.9	12.9
	Desired benefits of SWCT	6	4.3	4.3	17.3
	Crop farmed and thus choice of SWCT	30	21.6	21.6	38.8
	capital investment in the SWCT	6	4.3	4.3	43.2
	Authority to implement the SWCT	18	12.9	12.9	56.1
	Regularity of SWCT maintenance	61	43.9	43.9	100.0
	Total	139	100.0	100.0	

Primary data (2023) n=139

The data presented in the table shows the different ways in which land tenure systems influence the adoption of SWCTs. Out of the total respondents, 12.9% considered the choice of SWCT to be influenced by land tenure systems. 4.3% of the respondents considered the desired benefits of SWCT to be influenced by the land tenure system. 21.6% of the respondents considered the crops farmed and thus choice of SWCT to be influenced by land tenure systems. Another 4.3% of respondents considered capital investment in SWCT to be influenced by the land tenure system. 12.9% of respondents considered the authority to implement SWCT to be influenced by the land tenure system. The majority of respondents, 43.9%, considered the regularity of SWCT maintenance to be influenced by land tenure systems. These findings suggest that land tenure systems play a significant role in the adoption of SWCTs, particularly in terms of crop selection, investment decisions, and maintenance activities. The authority to implement SWCTs and desired benefits are also influenced by the land tenure system. Understanding the influence of land tenure on SWCT adoption is crucial for designing interventions that consider local contexts and factors that affect farmers' decisions. According to Omondi et al. (2018), these results highlight the importance of considering local land tenure systems when promoting the adoption of SWCTs, especially in terms of crop selection, investment decisions, and maintenance activities. It also emphasizes the need for interventions that account for the influence of land tenure systems on farmers' decision-making processes.

4.4.6: Physical factors influence the adoption of SWCTs amongst farmers

Figure 3.7: Physical factors influence the adoption of SWCTs amongst farmers



Primary data (2023) n=139

The table shows the frequency and percentage distribution of physical factors that influence the adoption of SWCTs amongst farmers. The physical factors identified include gradient of land, soil type, surface runoff, type of soil degradation, level of soil degradation, neighbouring land use, vegetation cover, type of crop farmed, and others.

The most common physical factor influencing the adoption of SWCTs is the level of soil degradation, which was reported by 34.5% of the respondents. Neighbouring land use and type of crop farmed were also frequently reported, at 20.9% and 22.3%, respectively. Other physical factors such as gradient of land, soil type, surface runoff, type of soil degradation, and vegetation cover were reported less frequently, at less than 6% each. This is confirmed by Wanjogu et al., 2021) who noted that it is essential to address the physical factors that influence the adoption of SWCTs when designing interventions aimed at promoting sustainable agricultural practices among smallholder farmers in rural areas.

4.4.7: The common sources of information on SWCTs amongst farmers

Table 4.11: The common sources of information on SWCTs amongst farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	relatives and friends	8	5.8	5.8	5.8
	social media and internet	20	14.4	14.4	20.1
	NGO extension services	3	2.2	2.2	22.3
	Government extension services	10	7.2	7.2	29.5
	Agricultural shows	2	1.4	1.4	30.9
	field demonstration	3	2.2	2.2	33.1
	newspapers and magazines	5	3.6	3.6	36.7
	National radio and television	6	4.3	4.3	41.0
	Vernacular and television	82	59.0	59.0	100.0
	Total	139	100.0	100.0	

Primary data (2023) n=139

The findings show that the most common source of information on SWCTs among farmers in the selected sub-counties of Mount Elgon region is vernacular and television, with a frequency of 82, which represents 59% of the respondents. This is followed by social media and internet with a frequency of 20 (14.4%), and government extension services with a frequency of 10 (7.2%). Other sources of information on SWCTs include relatives and friends, agricultural shows, field demonstrations, newspapers and magazines, and national radio and television. The results suggest that farmers in the region rely heavily on local media and communication channels to access information on SWCTs. This highlights the importance of using local and accessible communication channels when disseminating information on agricultural technologies to smallholder farmers in rural areas. According to Wanjogu et al.,(2021) it is essential to use local and accessible communication channels when disseminating information on agricultural technologies to smallholder farmers in rural areas

4.4.8: How information and awareness influence the adoption of SWCTs

Table 4.12: How information and awareness influence the adoption of SWCTs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Encourages or discourages adoption of SWCT	18	12.9	13.0	13.0
	Affects choice of SWC technology	6	4.3	4.3	17.4
	Influences the SWCT is practices	84	60.4	60.9	78.3
	influences the crops to be farmed	7	5.0	5.1	83.3
	Affects maintenance awareness of SWCT	20	14.4	14.5	97.8
	others	3	2.2	2.2	100.0
	Total	138	99.3	100.0	
Missing	System	1	.7		
Total		139	100.0		

Primary data (2023) n=139

The data shows that information and awareness have a significant impact on the adoption of SWCTs among farmers. The majority (60.9%) of respondents reported that information and awareness influenced the way they practiced SWCTs, while 13% reported that it encouraged or discouraged adoption. Additionally, 14.5% of respondents reported that information and awareness affected their awareness of SWCT maintenance. This suggests that education and awareness campaigns can play a crucial role in increasing the adoption of SWCTs and promoting their sustainable use. It is also important to note that the choice of SWCT technology and the crops to be farmed were affected to a lesser extent by information and awareness, indicating that other factors may be more influential in these decisions.

The importance of information and awareness in promoting the adoption of SWCTs among farmers is supported by several studies. In a study conducted by Asante-Darko et al. (2017) in Ghana, it was found that the level of awareness of SWCTs among farmers was positively correlated with their adoption of the technology. The study also found that farmers who had received information on SWCTs were more likely to adopt the technology than those who had not.

Another study by Chander et al. (2018) in India found that awareness campaigns played a crucial role in increasing the adoption of SWCTs among farmers. The study found that farmers who had participated in awareness campaigns were more likely to adopt SWCTs than those who had not. The study also found that the adoption of SWCTs was positively correlated with the level of education of farmers, indicating that education played a crucial role in promoting the adoption of SWCTs.

Similarly, a study by Jena et al. (2020) in India found that awareness campaigns and training programs were effective in promoting the adoption of SWCTs among farmers. The study found that farmers who had participated in training programs on SWCTs were more likely to adopt the technology than those who had not.

4.5: The significance of the relationship between SWCTs implemented and the factors influencing their adoption along the slopes of Mt Elgon

Table 4.13: Binary logistic regression model in assessing the influence of socioeconomic factors in the adoption of SWCTs.

VARIABLES	CATEGORIES	ß	S.E.	WALD	SIG	ODDS RATIO
Constant		1.11	1.23	0	0.0999	0
Age(31-45 years)	18-30 years	-0.961	0.61	2.5	0.114	0.383
	46-60 years	1.398	0.558	6.275	0.012*	4.044
	61 and above	1.307	0.648	4.085	0.043*	3.698
Gender (Male)	Female	-0.059	0.362	0.027	0.87	0.943
Level of education	Primary level	-4.001	1.774	5.108	0.024*	0.018
	Secondary level	-1.434	0.677	4.458	0.035*	0.238
	University	0.765	0.489	2.449	0.118	2.148
Sub-county(Bumalimba)	Bukhalu	-0.873	1.063	0.674	0.411	0.417
	Buyaga	-0.15	0.728	0.042	0.838	0.861
	Nabbongo	-2.17	1.528	2.031	0.154	0.115
	Bukiise	0.81	0.803	1.016	0.313	2.247
	Buhugu	-1.275	1.278	0.997	0.318	0.28
Occupation (Employed)	Self-employed	0.796	0.526	2.28	0.131	2.219
	Unemployed	-0.327	0.557	0.348	0.556	0.721
Household size(1)	2	0.782	0.908	0.729	0.393	2.186
	3	-0.191	0.958	0.039	0.843	0.825
	4	1.183	0.874	1.83	0.176	3.268
	5	0.68	1.115	0.371	0.542	1.974
	6	0.585	1.308	0.197	0.657	1.794
	7	-0.527	1.097	0.235	0.628	0.59

*** Significant at 5% probability level.

Primary data (2023) n=139

Individuals aged 46-60 years and 61 years and above have significantly higher odds of adopting SWCTs compared to those aged 31-45 years, with odds ratios of 4.044 and 3.698, respectively. In contrast, individuals aged 18-30 years have lower odds of adoption, with an odds ratio of 0.383. This suggests that older individuals are more likely to adopt SWCTs than younger individuals. The p-values for the age categories of 46-60 years and 61 and above are significant at 0.012 and 0.043, respectively. However, the odds ratio for the 18-30 age group is not significant at the conventional level (p=0.114). The analysis shows that age is a significant factor affecting the adoption of soil and water conservation technologies (SWCTs). However, the finding of Belete Limani Kerse (2017) opposes this suggestion. According to him, older farmer lack labor required to maintain SWC activities. Hence these situations affect farmer's attitude negatively on soil conservation structures

The results suggest that Gender (male or female) has a statistically insignificant relationship with the adoption of soil and water conservation technologies (SWCTs) in the selected sub-counties of Mount Elgon. The coefficient for gender is negative (-0.059), which suggests that being female is associated with a slightly lower odds of adopting SWCTs, but this association is not statistically significant (p-value = 0.870). Therefore, we can conclude that gender does not appear to be a significant factor influencing the adoption of SWCTs in the studied region. Result are not is in line with the argument that male headed house-holds are often considered to be more likely to get information about new technologies and take risky businesses than female-headed households (Ahsanuzzaman,2015).

The level of education of the household head is a significant predictor of SWCTs adoption. The coefficient for primary level education is negative and very large (-4.001), indicating that households headed by someone with only primary education are much less likely to adopt SWCTs compared to households with someone who has no formal education. Results showed that individuals with a primary education level have significantly lower odds of adopting SWCTs than those with college education (odds ratio of 0.018). On the other hand, households with a household head who has a university degree are more likely to adopt SWCTs, as indicated by the positive coefficient of 0.765. These findings are not consistent with previous research that suggests that education plays a critical role in technology adoption (Kassie et al., 2013).

Regarding sub-county, individuals from Bukhalu and Buhugu have significantly lower odds of adopting SWCTs than those from Bumalimba (reference category), with the odds ratio for Bukhalu is 0.417, which means that individuals from Bukhalu have 41.7% lower odds of adopting SWCTs compared to those from Bumalimba. Similarly, the odds ratio for Buhugu is 0.280, which indicates that individuals from Buhugu have 72% lower odds of adopting SWCTs compared to those from Bumalimba. On the other hand, the odds ratios for Buyaga and Bukiise are not significant, meaning that individuals from these sub-counties have similar odds of adopting SWCTs as those from Bumalimba. Therefore, the sub-county factor plays an important role in the adoption of SWCTs, with individuals from Bukhalu and Buhugu being less likely to adopt these technologies compared to those from Bumalimba. Kizza, Rugumayo, & Mugisha, (2020) comfirm that location is a key factor influencing the adoption of soil and water conservation technologies among smallholder farmers.

Occupation is an important factor influencing the adoption of SWCTs. The odds ratio for self-employed individuals is 2.219, indicating that they are more likely to adopt these technologies than employed individuals. On the other hand, the odds ratio for unemployed individuals is 0.721, which means they have lower odds of adopting SWCTs compared to employed individuals This implies that the occupation of individuals play a significant role in promoting the adoption of SWCTs in mountain Elgon, this is consistent with Mdoda, L. (2020) who stated that occupation is among the factors influencing the adoption of SWCTs.

Finally, household size is also a significant factor affecting the adoption of SWCTs. Individuals from households with two members have significantly higher odds of adoption than those from households with one member (odds ratio of 2.186). However, individuals from households with three members have lower odds of adoption (odds ratio of 0.825) compared to households with one member. Individuals from households with four, five, six, and seven members have significantly higher odds of adoption, with odds ratios of 3.268, 1.974, 1.794, and 0.590, respectively. The implication of this finding is that household size plays an important role in the adoption of SWCTs.

5.0. **SUMMARY, CONCLUSION AND RECOMMENDATIONS**

5.1 Introduction

The role of the study was to assess the factors influencing the adoption of SWCTs in selected sub-counties of Mount Elgon region, Uganda. The study was guided by the following objectives;-

i. To find out the SWCTs practiced by farmers along the slopes of Mt Elgon
ii. To find out the factors influencing the adoption of SWCTs by farmers along the slopes of Mt Elgon
iii. To establish the significance of the relationship between SWCTs implemented and the factors influencing their adoption along the slopes of Mt Elgon

5.2 Summary

The study aimed to identify the SWCTs practiced by farmers in the Mount Elgon region of Uganda, and the factors that influence their adoption. The study also aimed to establish the relationship between the SWCTs implemented and the factors influencing their adoption. The data was collected through a survey, and the results were analysed and summarized.

5.3. Discussion of key findings

The study found that farmers in the selected sub-counties of Mount Elgon region practiced various SWCTs such as terracing, agroforestry, and mulching. The adoption of SWCTs was influenced by several factors, including farmer education level, access to credit, extension services, and land tenure system.

The study established a significant relationship between the implementation of SWCTs and the factors influencing their adoption.

The study examined the adoption of soil and water conservation technologies (SWCTs) among farmers in selected sub-counties of Mount Elgon region. The study found that farmers in the region practiced various SWCTs such as terracing, agroforestry, and mulching. The results of the binary logistic regression model revealed that age and level of education of the household head were significant predictors of SWCTs adoption. Individuals aged 46-60 years and 61 years and above had significantly higher odds of adopting SWCTs compared to those aged 31-45 years, while individuals aged 18-30 years had lower odds of adoption. This suggests that older individuals are more likely to adopt SWCTs than younger individuals. The level of education of the household head was also a significant predictor of SWCTs adoption, with households headed by someone with only primary education being much less likely to adopt SWCTs compared to households with someone who has no formal education.

However, gender was not found to be a significant factor influencing the adoption of SWCTs in the studied region. The coefficient for gender was negative, suggesting that being female was associated with a slightly lower odds of adopting SWCTs, but this association was not statistically significant. The results suggest that gender does not appear to be a significant factor influencing the adoption of SWCTs in the studied region.

It is noteworthy that the findings of the study contradict the findings of previous studies on the impact of age on SWCTs adoption. Belete Limani Kerse (2017) found that older farmers lack the labor required to maintain SWC activities, which negatively affects their attitude towards soil conservation structures. On the other hand, the current study found that older individuals are more likely to adopt SWCTs than younger individuals. The study's findings highlight the need for targeted interventions aimed at promoting the adoption of SWCTs among younger farmers and those with a lower level of education.

5.4 Conclusion:

In conclusion, this study has provided insights into the factors that influence the adoption of SWCTs by farmers in the Mount Elgon region of Uganda. The study identified various SWCTs such as terracing, agroforestry, and mulching that are practiced by farmers in the region.

The study also found that the adoption of SWCTs is influenced by factors such as education level, access to credit, extension services, and land tenure system.

The study established a significant relationship between the implementation of SWCTs and the factors influencing their adoption.

The findings suggest that policymakers should prioritize education and extension services, improve access to credit, and promote secure land tenure systems to encourage the adoption of SWCTs among farmers in the region.

In summary, the study highlights the importance of promoting sustainable farming practices to protect the environment and enhance agricultural productivity in the Mount Elgon region of

Uganda. Further research is needed to explore the economic and environmental benefits of SWCTs and to identify additional factors that influence their adoption in the region.

5.5 Recommendations

Based on the study's findings, it is recommended that policymakers should prioritize education and extension services to encourage the adoption of SWCTs among farmers in the region.

Access to credit should also be improved to enable farmers to finance the implementation of conservation practices.

Policies that promote secure land tenure systems should be put in place and implemented to encourage farmers to invest in conservation practices without fear of losing their land. Additionally, future studies should focus on the economic and environmental benefits of SWCTs to encourage more farmers to adopt these practices.

The study recommends that extension services should focus on providing farmers with accurate and reliable information on SWCTs, as well as the financial resources to implement them.

The study also recommends that the government and other stakeholders should prioritize the provision of secure land tenure to encourage the adoption of SWCTs.

The study further recommends the development of social networks and farmer-to-farmer learning platforms to facilitate the adoption of SWCTs. Finally, the study recommends further research to explore the specific barriers and opportunities for the adoption of SWCTs in the Mount Elgon region of Uganda

The study's findings suggest that policymakers should prioritize education and extension services to encourage the adoption of SWCTs among farmers in the region.

5.6. Areas for further study

While this study has provided valuable insights into the factors influencing the adoption of SWCTs by farmers in the Mount Elgon region of Uganda, there are several areas for further study.

Firstly, future studies could focus on the economic and environmental benefits of SWCTs and their impact on agricultural productivity and sustainability. This would provide a more comprehensive understanding of the benefits of adopting SWCTs and help to encourage more farmers to adopt these practices.

Secondly, future studies could explore the role of social networks and peer influence in the adoption of SWCTs among farmers in the region. This would help to identify additional factors that influence farmers' decision-making regarding the adoption of SWCTs.

Thirdly, future studies could investigate the barriers to the adoption of SWCTs among farmers in the region, particularly for those who have not yet adopted these practices. This would help to identify strategies to overcome these barriers and promote the adoption of SWCTs among a wider range of farmers.

Finally, future studies could explore the impact of climate change on the adoption of SWCTs in the region. With increasing climate variability and extreme weather events, it is important to understand how these factors influence farmers' decisions to adopt SWCTs and how SWCTs can help to mitigate the effects of climate change.

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APPENDICES

Appendix 1: HOUSEHOLD QUESTIONNAIRE

FACTORS INFLUENCING THE ADOPTION OF SOIL AND WATER CONSERVATION TECHNOLOGIES IN SELECTED SUB-COUNTIES OF MOUNT ELGON REGION, UGANDA

Dear Sir/Madam

*I am carrying out a research on the '**factors influencing the adoption of soil and water conservation technologies in selected sub-counties of mount Elgon region, Uganda'**, I kindly request you to participate in the study by providing information requested below. The information provided was treated with utmost confidentiality and was used for academic purposes only. Thank you for your participation.*

Sincerely
Staden Mirembe

SECTION A: DEMOGRAPHICS

1. Which of the following subcounty do you reside in and carry out your farming activities?

( ) Bukhalu ( )Buyaga ( )Nabbongo ( )Bukiise ( ) Buhugu ( )Bumalimba

2. Gender(tick/check one); ( ) Male ( ) Female ( ) Prefer not to say

3. Age (tick/check one); ( ) 18-30 years ( ) 31-45 years ( ) 46- 60 years ( ) 61 & above

4. What is your highest level of education? *(Tick appropriately)*

( ) University College ( ) College ( ) Secondary level ( ) Primary level

( ) No Education

5. (i) How many members in total are you in this household?

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11+)

(ii) How many members of the family are aged 12 years and above?

(1)	(2)	(3)	(4)	(5)	(6)	(7+)

(iii)How many members of the family are ages 11 years and below?

(1)	(2)	(3)	(4)	(5)	(6)	(7+)

(iv)Who is the head of the family and has control over agricultural land?

(a) Husband	(b) wife	(c) Other adult guardian (specify relation) ………………

6. What are your main sources of income?

( ) Subsistence farming	( ) Agribusiness	( ) Retail trade	( )Employment

SECTION B: Soil and Water Conservation Technologies (SWCTs)

7. **(i) What common soil and water management challenges faced by farmers here? (Tick as many as are applicable)**

( )	Soil Erosion	( )	Mud slides/ debris flow	( )	Reduced soil fertility
( )	reduced water retention	( )	reduced soil humus	( )	Other specify …….

8. (i**) Which SWCTs are practiced by farmers in this area? (Tick as applicable)**

( )	Agroforestry	( )	Fallowing	( )	Mulching
( )	Vegetative / grass strips	( )	Cut off drains and waterways	( )	Fanya juu
( )	Minimum / zero tillage.	( )	Bench Terraces & Soil bunds	( )	Intercropping

(ii) At what frequency are SWCTs implemented by farmers in this area?

( )	Monthly	( )	Once 2- 3 months	( )	Once every 6 months
( )	Once every year	( )	Once every two years	( )	Other specify ……

(ii) Which three main SWCTs are considered most effective by farmers in this area? (Tick as applicable)

( )	Agroforestry	( )	Fallowing	( )	Mulching
( )	Vegetative / grass strips	( )	Cut off drains and waterways	( )	Fanya juu
( )	Minimum / zero tillage.	( )	Bench Terraces & Soil bunds	( )	Intercropping

SECTION B: factors that influence the adoption of SWCTs

9. **(i) Which THREE labor-related factors influence the adoption of SWCTs? (*tick as appropriate)***

( )	Availability	( )	Type of labor	( )	Cost of labor
( )	labour efficiency	( )	Consistency of labour	( )	Other (specify)

10. What costs and profitability factors that influence adoption of SWCTs? (*tick as appropriate)*

( ) production costs	( ) Productivity and profits	( ) longevity of benefits
( ) Cost of SWCT inputs	( ) alternative income potentials	( ) Cost of farm manual routines
( ) Other specify ……………………………………….		

11. Which THREE social demographic factors influence the adoption of SWCTs (*tick as appropriate)*

( )	Size of household/ defendants	( )	Gender of household head
( )	Education level	( )	Availability of household labour
( )	neighboring farmer relations	( )	farmer group Membership
( )	main income sources	( )	Other factors…….

12. (i) What are the common land tenure systems along the slopes of Mt Elgon? ((***tick one)***

( )	Leased land	( )	Communal ownership	( )	Private owned	( )	Other specify.

(ii) How do land tenure systems influence the adoption of SWCTs? (***tick as appropriate)***

( )	choice of SWCT	( )	Capital investment in the SWCT
( )	desired benefits of SWCT	( )	Authority to implement the SWCT
( )	crops farmed and thus choice of SWCT	( )	regularity of SWCT maintenance

13. Physical factors influence the adoption of SWCTs amongst farmers? (***tick as appropriate)***

( )	Gradient of the land	( )	Type of Soil degradation	( )	Vegetation cover
( )	Soil type	( )	Level of soil degradation	( )	Type of crops farmed
( )	Surface runoff	( )	Neighboring Land use	( )	Others ……..……………

14. (i) **The common sources of information on SWCTs amongst farmers**? (***tick as appropriate)***

( ) relatives and friends	( ) Government extension services	( ) newspapers & magazines
( ) Social media & internet	( ) Agricultural shows	( ) National radio & TV

( ) NGO extension services	( ) Field demonstration	( ) Vernacular radio & TV

(ii) How information and awareness influence the adoption of SWCTs? (*tick as appropriate)*

( ) Encourages or discourages adoption of SWCT	( ) Influences the crops to be farmed
( ) Affects choice of SWC technology	( ) Affects maintenance awareness of the SWCT
( ) Influences the how the SWCT is practiced	( ) Others (specify)…………………

The End

Thank you for your responses

Appendix 2: QUESTIONNAIRE FOR KEY INFORMANTS

FACTORS INFLUENCING THE ADOPTION OF SOIL AND WATER CONSERVATION TECHNOLOGIES IN SELECTED SUB-COUNTIES OF MOUNT ELGON REGION, UGANDA

Dear Sir/Madam

*I am carrying out research on the '**factors influencing the adoption of soil and water conservation technologies in selected sub-counties of mount Elgon region, Uganda'**, I kindly request you to participate in the study by providing information requested below. The information provided was treated with utmost confidentiality and was used for academic purposes only. Thank you for your participation.*

Sincerely

Staden Mirembe

SECTION A: DEMOGRAPHICS

1. **Occupation**; ( ) extension officer ( ) water officer ( ) NGO\CBO worker

2. Which of the following subcounty has more farming activities?

( ) Bukhalu ( )Buyaga ( )Nabbongo ( )Bukiise ( ) Buhugu ( )Bumalimba

3. What is your highest level of education? *(Tick appropriately)*

( ) University College ( ) College ( ) Secondary level ( ) Primary level

4. (i) a. in your opinion does the size of household affect adoption of SWCT? YES/ NO

   b. if yes why ……………………………………………………………………………..

   (ii) How does household age and gender composition structure affect adoption of SWCT …………………………………………………………………………………………………..

   …………………………………………………………………………………………………

   (iii)Do head of the family control over agricultural land and affect adoption of SWCT? How?
   …………………………………………………………………………………………………

5. Does a household's main source of income affect the affect adoption of SWCTs? How?

……………………………………………………………………………………………

SECTION B: Soil and Water Conservation Technologies (SWCTs) (Objective one)

6. (i) **What common soil and water management challenges faced by farmers here? (Tick as applicable)**

( )	Soil Erosion	( )	Mud slides/ debris flow	( )	Reduced soil fertility
( )	reduced water retention	( )	reduced soil humus	( )	Other specify …….

(ii) **What mitigations can you recommend**…………………………………………………..

7. (i) **Which SWCTs are practiced by farmers in this area? (Tick as applicable)**

( )	Agroforestry	( )	Fallowing	( )	Mulching
( )	Vegetative / grass strips	( )	Cut off drains and waterways	( )	Fanya juu
( )	Minimum / zero tillage.	( )	Bench Terraces & Soil bunds	( )	Intercropping

(iii) At what frequency are SWCTs implemented by farmers in this area?

( )	Monthly	( )	Once 2- 3 months	( )	Once every 6 months
( )	Once every year	( )	Once every two years	( )	Other specify ……

(iv) Which three main SWCTs are considered most effective by farmers in this area? (Tick as applicable)

( )	Agroforestry	( )	Fallowing	( )	Mulching
( )	Vegetative / grass strips	( )	Cut off drains and waterways	( )	Fanya juu
( )	Minimum / zero tillage.	( )	Bench Terraces & Soil bunds	( )	Intercropping

(v) **In view of your answers for questions (i), (ii) and)iii) any recommendations for future SWCT implementation** ……………………………………………………….…………

……………………………………………..……………………………………

SECTION B: factors that influence the adoption of SWCTs (Objective two)

8. (i) Which THREE labor-related factors influence the adoption of SWCTs? (*tick as appropriate)*

( )	Availability	( )	Type of labor	( )	Cost of labor
( )	labour efficiency	( )	Consistency of labour	( )	Other (specify)

(ii) in view of your answer above what interventions can remedy these challenges …………

……………………………………………………………………………………………….

9. **(i) What costs and profitability factors that influence adoption of SWCTs?** (***tick as appropriate)***

( ) production costs	( ) Productivity and profits	( ) longevity of benefits
( ) Cost of SWCT inputs	( ) alternative income potentials	( ) Cost of farm manual routines
( ) Other specify ……………………………………….		

(ii) in view of your answer above what interventions can remedy these challenges

……………………………………………………………………………………………….

10. **(i) Which THREE social demographic factors influence the adoption of SWCTs (*tick as appropriate)***

( )	Size of household/ defendants	( )	Gender of household head
( )	Education level	( )	Availability of household labour
( )	neighboring farmer relations	( )	farmer group Membership
( )	main income sources	( )	Other factors…….

(ii) in view of your answer above, what interventions can remedy these challenges

……………………………………………………………………………………………….

11. **(i) What are the common land tenure systems along the slopes of Mt Elgon? ((*tick one)***

( )	Leased land	( )	Communal ownership	( )	Private owned	( )	Other specify.

(ii) Which land tenure system most affects SWCT implementation?

( )	Leased land	( )	Communal ownership	( )	Private owned	( )	Other specify.

(iii) How do land tenure systems influence the adoption of SWCTs? (***tick as appropriate)***

( )	choice of SWCT	( )	Capital investment in the SWCT
( )	desired benefits of SWCT	( )	Authority to implement the SWCT
( )	crops farmed and thus choice of SWCT	( )	regularity of SWCT maintenance

12. **(i) Physical factors influence the adoption of SWCTs amongst farmers?** (***tick as appropriate)***

( )	Gradient of the land	( )	Type of Soil degradation	( )	Vegetation cover
( )	Soil type	( )	Level of soil degradation	( )	Type of crops farmed

( )	Surface runoff	( )	Neighboring Land use	( )	Others ……..……………

(ii) **in view of your answer above, any comments** ……………………………………..

……………………………………………………………………………………………………

13. (i) The common sources of information on SWCTs amongst farmers? (*tick as appropriate)*

( ) relatives and friends	( ) Government extension services	( ) newspapers & magazines
( ) Social media & internet	( ) Agricultural shows	( ) National radio & TV
( ) NGO extension services	( ) Field demonstration	( ) Vernacular radio & TV

(ii) How does information and awareness influence adoption of SWCTs? (*tick as appropriate)*

( ) Encourages or discourages adoption of SWCT	( ) Influences the crops to be farmed
( ) Affects choice of SWC technology	( ) Affects maintenance awareness of the SWCT
( ) Influences the how the SWCT is practiced	( ) Others (specify)…………………

The End

Thank you for your responses

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