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SOCIO-ECONOMIC FACTORS AFFECTING CROP DIVERSIFICATION DECISIONS AMONG SMALL SCALE MAIZE FARMERS IN UASIN-GISHU COUNTY

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ABSTRACT

Poverty has remained a major challenge in Sub-Saharan Africa due to sluggish income growth. Since most of the population in Sub-Saharan Africa depends on Agriculture as their main source of income, they can cap the problem through crop diversification strategies. Using descriptive and survey designs, this study characterized crop diversification among small-scale maize farmers in Uasin-Gishu County, it also determined socio-economic and institutional factors affecting crop diversification among small-scale maize farmers in Uasin-Gishu County, and determined the effect of crop diversification on income level among small-scale maize farmers in Uasin-Gishu County. Descriptive statistics was used to characterize crop diversification; Binary logistic model was used to analyze socio-economic and institutional factors affecting crop diversification. Gross Margin Analysis and Foster-Greer-and Thorbecke measures of poverty were used to determine the rate of poverty while descriptive statistics was used to determine the relationship between crop diversification and household rate of poverty. Both interview schedules and questionnaires was used to collect information from small-scale maize farmers. The sample size was 153 randomly selected small-scale maize farmers across Uasin-Gishu County, Statistical Package for the Social Sciences (SPSS) 26 edition was used in data analysis. The results were presented using tables, bar charts, graphs and figures. Information generated would assist policy makers come up with proper and sound strategies to crop diversification geared towards increasing household productivity, income, food security and hence poverty alleviation.

1.0 INTRODUCTION

With the majority of its population living below the World Bank's 2022 poverty line of $2.15 per day, Africa is the final remaining untapped market in the fight against poverty. A majority of Africans work in agriculture, which accounts for about 35% of the continent's GDP but has low productivity and a high rate of food insecurity. Food availability in Sub-Saharan Africa is still poor, according to a report from the Food and Agriculture Organization (FAO), UNICEF, the International Fund for Agricultural Development (IFAD), the World Health Organization (WHO), and the World Food Programme (WFP). Progress in improving access to food has also been sluggish because of low income and high poverty rates (FAO, 2016). Crop diversification, according to the United Nations Sustainable Development Goals (SDG) agenda, is required to meet the first SDG of "No Poverty" (United Nations, 2015).

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Maize farming has been practiced in Kenya for a long time since it was introduced by the Portuguese in the 16th century. With time maize has become the main staple food for Kenyans gradually replacing the indigenous foods. In addition, maize farming also serves as a source of income for many farmers. Kenya produces an average of 23 million bags of maize annually with Uasin Gishu County accounting for 14.3% (3.29 million bags) of this national output.In 1990's, Kenya was a net exporter of maize. This trend has now reversed and the domestic demand is higher than the domestic production. In 2017 for example, the country produced 37 million bags of maize against a requirement of 52.8 million bags for the same year. Kenya is indeed one of the subSaharan countries that have recorded negative gains in maize production and is now a net importer of this commodity. For the last few years, there has been a public outcry from maize farmers in relation to marketing and pricing.

Crop diversity is increasing worldwide in favor of high-value crops that are more marketable. To reduce the vulnerability of their livelihood to market or weather shocks, farmers have diversified their output and income risk (FAO, 2018; Mango et al., 2018). Crop diversification, according to Nguyen (2014), is a strategy for increasing exports and competitiveness in both home and foreign markets by avoiding less lucrative crops, changing variety and cropping practices, and avoiding less lucrative crops. According to Clements et al. (2011) and Feliciano (2019), crop diversification is associated with the substitution of low-value goods with high-value ones, particularly fruits and vegetables for the export market.

Malnutrition now affects about 20 percent of Africans, or nearly 282 million, up from 222 million in 2016 with an increase of 57 million people since the covid-19 pandemic began (FAO, 2023). Due to the challenging global economy, conflicts, and climate-related disasters in many countries, often in combination, the situation in Africa is getting worse. Several countries in Southern and Eastern Africa have been severely impacted by extended drought, which has worsened food insecurity in conflict-affected areas and can occasionally be made worse by floods or drought. Notably, several nations have consistently progressed in lowering food insecurity despite challenging circumstances.

Africa created Agenda 2063, a comprehensive policy framework for sector reform, realizing that agriculture is essential to her development toward the global goals of ending hunger and poverty and reducing food insecurity in the face of adversity. A framework for the socioeconomic development of the continent during the following 50 years is provided by Agenda 2063. In order to speed their implementation, it builds on existing and previous continental initiatives for economic and sustainable development. The plan calls for sector improvements, including a 10% commitment of public spending to the farm sector and a 6% annual increase in agricultural GDP. Africa understands that increased agricultural productivity is essential for economic development and the eradication of poverty since it creates jobs, broadens possibilities for women and youth, and enhances food and nutrition security and resilience (UN-OSAA 2015).

It may be easier for African farmers to adapt to change since they have historically varied their farming operations to address risks from the environment and other factors (Ebi et al., 2011). This can be accomplished by reducing risks (Antwi-Agyei, Stringer, and Dougill, 2014), increasing revenues (Block and Webb, 2001), or expanding the range of agricultural products for consumption or markets (McCord, Cox, Schmitt-Harsh, and Evans, 2015). Selling one's

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own goods is crucial for Sub-Saharan African farmers' overall food security outcomes. According to Frelat et al. (2016), 83% of agricultural households in Sub-Saharan Africa sell a portion of the crops they produce. This happens frequently before they have enough to be self-sufficient.One method of gauging agricultural diversity is through crop and farming diversification (Frelat et al., 2016). The variety of crops grown as well as the total number of farming operations, including livestock husbandry, are referred to as crop and farming diversity.

Many East African populations make the majority of their living from agricultural products (Altieri, 1999). According to Altieri, Funes-Monzote, and Petersen (2012), the majority of farmers in this region are smallholders who engage in "low-resource" agriculture on less than 5 acres (2 hectares) of land, which is expected to continue to shrink as a result of current land fragmentation and unchecked urban center expansion. Due to their limited financial resources, these farmers are more vulnerable to the overall effects of climate change (Lin, 2011). One of the most practical, economical, and environmentally beneficial methods of decreasing agricultural uncertainty, particularly among small-scale producers, is crop diversity. In this method, different crop varieties from the same or other species are planted in a specific area.

In East Africa, there has always been a problem with food insecurity. The regional governments, the donor community, regional economic groups, and Farmer Organizations (FOs) have all invested a lot of time and resources into finding a solution to this problem. The promotion of food security and sane agricultural output is one of the primary goals of the East African Community (EAC), as stated in the treaty (EAC food policy, 2005). According to Roberto et al. (2013), by 2050, the agricultural sector must produce significantly more food to feed a growing global population while simultaneously supplying rural poor people who depend on agriculture with economic prospects. Diversifying food crop production is the only approach to address the issues raised above.

The Global Multidimensional Poverty Index (2019) shows that Kenya's national poverty line is 36.1%, demonstrating the severity of the country's poverty problem. In order to raise the standard of living for our people while also generating rapid economic growth, sustained agricultural expansion is essential. Despite the sector's importance, Kenyan agriculture has long been small-scale, rain-fed, and insufficiently automated (Agricultural Sector Development Strategy, GoK, 2010-2020).

Agriculture is one of the significant industries intended for development in the county, according to the County Integrated Development Plan 2018–2022. Contrarily, poverty and food insecurity remain significant problems in the county (County Government of Kakamega, 2017). By enhancing food security, generating employment, and giving county residents access to financial resources, agriculture can aid in the reduction of poverty.

Studies from the western Kenyan districts of Lurambi, Koyonzo, and Chemelil demonstrate that farmers only kept 32, 31, and 34% of the gross income from contract maize farming, respectively, according to Waswa et al. (2012). Although conventional input costs have varying effects on net income depending on the site, yield seems to be a major factor in determining gross income. Farmers' net income was significantly lowered as a result of company-driven deductions over which they had little control. Such unequal revenue distribution, in which

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sugar firms retain at least 60% of total revenues, raises issues about sustainability, which must be addressed by a participatory strategy including all key stakeholders.

In response to the poverty problem, the Kenyan government has prioritized crop diversification and agricultural value addition. Catalyzing increased agricultural production, food security, and economic growth through crop diversification is one of the key policy concerns and strategies mentioned in Kenya Vision 2030 (Agricultural Sector Development Strategy, GoK, 2010-2020). In addition, in March 2004, the Kenyan government designed and implemented the strategy for agricultural revitalization (SRA). The strategy outlined the government's ambition for transforming Kenya's agriculture into a profitable one. This was to be accomplished with improving agricultural production and farm incomes while protecting the land resource base and the environment (Agricultural Sector Development Strategy, GoK, 2010-2020).

Crop variety improves farmers' ability to deal with the risk of fluctuating income and food insecurity. It also assures a steady flow of income from various crops throughout the year, so alleviating poverty.

Agriculture is thought to be important in poverty alleviation. Nonetheless, poverty in Uasin-Gishu remains high, despite numerous research on possible strategies to alleviate poverty in the county. According to the Kenya National Bureau of Statistics (KNBS), (2019), 3% of the county is classified as having a high poverty rate. The studies have linked this poverty mostly to climate change, over reliance on rain fed agriculture but less has been done on crop diversification. Small-scale farmers in Uasin-Gishu County have for long relied on maize for food and income. Maize however have low market value compared to horticultural crops. The study hypothesized that the increasing household poverty among small-scale farmers in Uasin-Gishu County was likely due to the low incomes from these traditional crops. In response to the increasing poverty, the small-scale maize farmers In Uasin Gishu County are diversifying to horticultural crops (high value crops) with an objective to raise household incomes and thus eradicate poverty. Currently, scanty information exists on the role these high value crops play in alleviating poverty at household level in Uasin-Gishu County. This study helped fill this knowledge gap.

2.0 LITERATURE REVIEW

Determinants of people's decision on adoption of new technologies or practices like diversification have been studied by different scholars over time. The classic theory of diffusion of innovations considers the impact of social norms and values, individual characteristics, traits of the concerned technology as well as other external factors such as infrastructure and the policy environment. Ellis, (2000) also indicates that the decision to adopt an innovation is determined by a risk minimizing strategy as they are quite vulnerable to a risk arising out of natural and anthropogenic uncertainties. Due to such uncertainties, farmers in developing countries are vulnerable to various risks that the severity leads to the eventual loss of assets and income.

A number of scholars have carried out studies on crop diversification in many places such as India, China, Pakistan and many African countries like Nigeria, Malawi, Zambia, Ethiopia, Zimbabwe and Kenya among others. The bulk of these studies concluded that social,

demographic, and institutional factors have a key role in crop diversification. Kumar, Kumar, and Sharma (2012), for example, aimed to establish the status of agricultural diversification and identify its causes in Eastern India. The kind of determinants they evaluated were age and education of the household leader, agriculture as the main occupation, household size, credit access, farm assets, and operated area, use of technology components, infrastructure and caste. Three stage and stratified sampling was used in this study where 2885 farmers were studied. They used Herfindahl Index to establish the extent to which farmers have diversified their crop production while Tobit regression model was applied in identifying elements of diversification towards vegetable cultivation in the study area. They established that the crop sector in the eastern region was moderately diversified. The study also showed that education, size of the household, value of productive assets and the primary household head's occupation had very significant influence on diversification. Age and gender however did not have a substantial influence on farmers' decision to diversify in favor of vegetables. Aheibam, Singh, Feroze, and Singh (2017) used Heckman's two-stage model to examine the determinants of household diversification and its intensity while attempting to discover factors that guide family decision to diversify crop production in Ukhonul District, Manipur. The findings indicated that the education of the household's head had a positive relationship with the level of crop diversification, which is consistent with Kumar et al, (2012), Mithiya, Mandal, & Datta, (2018), and Shabzah et al, (2017). Other factors with positive influence are access to fertilizer, access to plough, availability of irrigation, exposure to farming information regularly, distance to the nearest market and experience of the farmer.

Mithiya et al., (2018), while seeking to establish trends of crop production and identify factors of their diversification by smallholders in West Bengal, used secondary data from different districts. Using Simpson Index (SI) which was also used by Aheibam, (2017), the results showed that every district in Western region of Bengal and the whole state demonstrated higher crop diversification levels during new millennium in relation the nineties. The factors analyzed include level of literacy, urban population percentage of the district, comparative earnings from high value crops compared to cereals, regional market density, smallholders' percentage and area under high yielding food grain varieties. Education, land size, distance from the market as well as income from other sources had a significant influence.

Huang', Jiang', Wang' & Hou, (2014) also investigated how crop diversification is used as a coping mechanism against extreme weather occurrences in China. They used multiple stage sampling to obtain 3330 smallholder farmers. It was established that age had an undesirable effect on diversification where aged farmers did not implement crop diversification compared to young farmers. Young farmers were more inclined to use crop diversity as a way to reduce production risks since they had less expertise. Younger people also shown a greater willingness to experiment. The results of Aheibam et al. (2017), Dube, Numbwa, and Guveya (2016), and Ojo et al. (2014) are all in agreement with this. According to Huang's research, farmers with lower levels of education are more sensible and are more likely to use crop diversification to mitigate the risks associated with extreme weather occurrences. Huang also found that farmers with larger farmlands are more willing to mix up their crop varieties. Since more arable land is accessible and makes it easier for a household to plant more crops, it was expected that they would cultivate more crops.

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While seeking to identify determinants of crop diversification in mixed cropping zone of Punjab in Pakistan, Shahbaz, Boz & Ul Haz, (2017) used multiple stage sampling to select 100 growers for the study. They applied Herfindahl index to calculate the farmer's level of diversification which has been used by many other scholars such as Kumar et al, (2012), Ojo et al, (2014) and Kanyua, Ithinji, Maluvi & Gido, (2013). The expected elements of crop diversification were analysed using Tobit model which was also used by Kumar et al, (2012), Ojo et al, (2014) and Kanyua et al, (2013). It was established that level of education and farm size positively and significantly influence how farmers vary crop production. A more educated farmer would understand the market condition better thus resolves impact of the uncertain events in an appropriate manner. Similarly, ownership of farm machinery enhanced the levels of diversification in crop cultivation. The study nevertheless indicates an undesirable relationship between age and diversification in crop production. This is possibly because younger farmers have the ability to innovate, take risk and are physically strong in farming activities unlike old people. The study also revealed that self - owned operated farms were less diversified in crop production compared to other tenures like rented or shareholder.

Research was also done by Sichoongwe (2014) to look at the causes and levels of crop diversification in smallholder farming in Zambia's Southern Province. He looked at gender, age, household size, land holding size, number of fields or land plots, hired labor, tillage time, plough tillage, fertilizer quantity, and distance from the market for 1,555 farmers. He also looked at the head of the family's education level, age, and gender. Sichoongwe found that there was little crop variety in smallholder farming. His research revealed that the size of the land holding, the amount of fertilizer, the proximity to the commodities market, and the length of the tillage, including tillage, had a significant impact on crop diversification.

Dude et al. (2016) conducted a study in the Zambian provinces of Manicaland and Masvingo to determine the variables affecting the crop diversification of 479 smallholder farming families. The Herfindahl Index was used to gauge the degree of diversification, and the Tobit regression model was used to look into the elements that influence it. The findings of this study indicated that homes with male heads were a little more diversified than households with female heads. The Tobit regression model also showed that household income, flat-land farms, farmer-to-farmer extension, livestock unit count, irrigation access, membership in a farmers' group, market access, education, and farming experience were the most important factors in crop diversification.

Ojo et al. (2013) also investigated the factors that influence small-scale food crop agricultural diversification in North Central Nigeria. A total of 300 people were sampled using multiple stages of sampling. Using Herfindahl Index, their study revealed that North central Nigeria smallholders were less diversified. The study also showed that experience, extension contacts as well as land size positively influenced diversification. Age and income from other sources however had no influence. Rahman and Chima (2015) employed the Multivariate Tobit technique in another study to investigate the profitability of food crop diversity and its determinants in the southeastern part of Nigeria. According to their findings, farm size is the most important factor of variety when compared to profitability. Other variables that influence market and extension office proximity, extension contact, training, agricultural credit, and subsistence. The survey included 450 households in total.

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Crop diversification was found to have a strong positive link with farm income by Makate et al. (2016), BravoUreta et al. (2006), and Perz (2004). Similar relationships were also found in El Salvador, Honduras, and the Brazilian Amazon. Perz (2004) found a very substantial positive correlation between diversity and revenue, contrary to what BravoUreta et al. (2006) predicted would happen for the entire study sample. Makate et al. (2016) found that higher crop output from different farming strategies led to higher farmer income.

The pattern and trajectory of crop diversification among 167 small-scale farming households in Ethiopia's Eastern region, as well as the reasons for this diversification, were examined by Mesfin et al. (2011). The intensity and driving forces for agricultural diversification were examined using the Tobit regression model. Farm size, household size, household age, distance to market, number of extension contacts, farm machinery (truck and water pump), off-farm income, number of farm plots, access to market information, irrigation intensity, and household sex were some of the factors assessed. The degree of agricultural diversification was measured using a modified Entropy Index. Mesfin discovered that farmers with more plots are more likely to diversify by producing different crops on each plot of land, which is consistent with Mussema et al, (2015) and Ogutu and Obare, (2015) findings. Farmers were also shown to be more inclined to diversify if they had access to market information, irrigation, and machinery. However, the data indicated a negative association between extension contacts and diversity since extension was arguing for productivity and profitability, which supported specialization at the micro level and overlooked the significance of diversification in risk mitigation.

In a different study to identify the causes of agricultural diversification in the Oromia area of Ethiopia, Mussema et al. (2015) used Margalef's Index (MI) to evaluate crop diversification drivers. The findings demonstrated that crop diversification is influenced by asset ownership, soil quality, agricultural extension, and the degree of infrastructure development. 382 households were reached using a three-stage sampling method. The findings demonstrated that the size of the land and the number of plots had a favorable and significant influence on decisions on crop diversification. Similar to that, having access to all-weather roads, being aware of the market, and using Extension services all had a big positive influence. They reached the same conclusions about market access as Kumar et al. (2012), Mithiya et al. (2018), Sichoongwe et al. (2014), Dube et al. (2016), and Kanyua et al. (2013).

Kanyua et al. (2013) also investigated the factors influencing horticultural diversification and intensification among smallholder tea producers in Kenya's Gatanga District. Participation in various cash crop farming, occupation, age and education level of the household head, tools, credit, distance from the market, and contract were all investigated. To determine the determinants, the Heckman two-step model was employed, and it was determined that farm size and farm tool value were the most influential in crop diversification.

The Heckman two step approach was also applied by Aheibam et al. The study also found that the size of a farmer's farm has a significant impact on the level of diversity, with a larger farm size being correlated with a higher crop diversification index. They discovered that the farmer's decision to diversify into horticulture production was significantly influenced by the amount of free land he or she had. On the other hand, because more land had been allocated to tea, other large-land farmers had a limited variety of crops. The diversification of tea growers into horticulture was significantly influenced by gender; households headed by men were more

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diversified than those led by women. This was consistent with the findings of Dube et al. (2016), who discovered that male-headed families were more diverse. The household head's experience had a substantial effect on the degree of diversification, probably due to learning curve effects.

Finally, Ogutu and Obare (2015) examined crop selection and implementation of sustainable agricultural intensification strategies among 532 randomly recruited smallholder families in Eastern and Western Kenya. They used a stochastic production function model to show that gender influenced the adoption of sustainable agricultural intensification (SAI) innovation and cropping decisions. Female decision makers were observed intercropping more in their plots. The size of the land and the number of plots had a good impact as well. However, education had no effect on SAI practice or crop selection, although income from other sources had a negative impact.

However, none of the preceding research focused on smallholder farmers' diversification within the food crops sub-sector. This study fills a knowledge vacuum regarding this element of diversification by smallholder households.

3.0 RESEARCH METHODOLOGY

Correlation and cross-sectional research designs were utilized in this study. According to Creswell & Creswell (2017) as study can have quantiative, qualitative or mixed approach to research. Correlation design plays an important role in testing the hypothesis mainly in establishing the link between two or more variables (Abbott & McKinney, 2013). This allows correlation design to be adopted in quantitative data. Cross-sectional survey research design benefits from quantitative based on its ability to collect data at a snapshot of time (Creswell & Creswell, 2017). These designs were preferred because they are exploratory, allow for comparisons and analysis of the research findings, and also enables the researcher to collect, summarize, present, evaluate and interpret the data in a simpler and more understandable form (Kothari, 2008).

Asiamah, Mensah, & Oteng-Abayie (2017) defined target population as a representation of the specified scope where specific features are neccesary in obtaining the objective of the study. Kothari (2011) defines population as the domain of the researcher. The target population, according to Sekaran and Bougie (2016), is a group of people or circumstances that the researcher wants to study. According to them, the characteristics of a study population should align with the interests of the researcher. The study targeted 45,331 small-scale maize farmers in the county who cultivate less than 3 acres of land.

A sample size is a scientific method that is used in obtaining a sample from target population and ensuring that the right data with required characteristics are collected (Masuku & Sing, 2014). Sarantakos (2005), defined sampling as choosing units of a study population that are to be included in the study in such a way that it is a representative of the entire population. The study adopted the formula by Nassiuma, (2000) to determination the sample size as shown in equation 1. This equation was used to determine the nth value, which is the sample size.

$$n = \frac{NC^2}{C^2+(N-1)e^2} \quad \text{.....(1)}$$

Where the population is N, the sample size is N, the coefficient of variation is C, and the standard error is e. A 25% coefficient variation and a 2% standard error was used in the investigation. To achieve low variability and reduce error in the sample, the lower limit for the coefficient of variation and standard error was determined. The formula is as follows

$$n = \frac{45{,}331 \text{x} 0.25^2}{0.25^2 + (45{,}331 - 1)0.02^2} = 155.72$$

≈ 156 farmers.

Sampling Procedures

Kothari (2011) explains sampling procedure as the process of selecting portions of an aggregate or totality from which a judgment or conclusion is made. By concentrating only on a small portion of the population, it is the process of learning details about the entire population. According to Copper & Schindler (2011), Mugenda and Mugenda (2012), inferential statistics frequently use sampling to make predictions about population behavior. A researcher can be certain that the sample accurately reflects the characteristics of the population by using sampling techniques.

Multistage cluster sampling was used. Multistage cluster sampling entails various stages which was employed in the research and since Uasin Gishu County has a large population of farmers, this sampling technique was cost and time effective. In the first stage, the farmers were grouped into clusters whereby each Sub County formed a cluster. This hence gave researcher six clusters to study.

The target samples were randomly selected from each cluster in the second stage. To ensure that each farmer had an equal chance of being chosen and to create a representative sample size, the names of the farmers on the lists from each sub-county agricultural office was serially numbered and randomly chosen.

Based on the proportionate size sample calculation, a sample of 156 small scale maize farmers were selected as shown in table 1.as 29,16,19,31,35 and 26 small scale maize farmer households were sampled from Kesses, Kapseret, Turbo, Ainabkoi, Moiben and Soy Sub-Counties respectively. These was a representative of small-scale maize farmers' households for the study in the county.

Table 1: Proportionate Distributions of Small-Scale Farmers per Sub County

Sub County	Number of Households	Number of small scale farmers	Percent of small scale farmer Households	Total proportion
Kesses	34,653	8,481	18.7	29
Kapseret	59,748	4,622	10.2	16
Turbo	75,139	5,491	12.1	19

Ainabkoi	34,892	9,016	19.9	31
Moiben	46,729	10,109	22.3	35
Soy	53,784	7,612	16.8	26
Uasin Gishu county	304,945	45,331	100	156

Source: Author's Computation from UG County Development Profile, 2019 and KNBS (2019) Census.

Data Collection Instruments

This study used both primary and secondary data. Primary data was collected directly from the management using structured questionnaires. Structured questionnaires were used for data collection. According to Taherdoost (2016) semi-structured questionnaires are appropriate since it has open and close ended questions which allow the researcher to extract both qualitative and quantitative data without affecting the respondents.

Data was collected using questionnaires from samples of farmers in Uasin Gishu County. This is a list of items to which respondents are supposed to respond in writing. This method collects a large amount of data in a short period of time. Closed and open-ended questionnaires was utilized in this study to acquire vital information from farmers. Respondents can then express themselves as necessary. The questionnaire has the benefit of producing a lot of data and enabling the researcher to obtain a wider coverage of descriptive data for a relatively little investment of time, money, and effort. As a common research tool, it permits comparison between respondents and allows for consistency in the way that questions are posed. Other data was generated through scheduled interviews of farmers within the sample size.

Data Analysis and Presentation

Data analysis includes editing, coding, classification, tabulation, and graphical presentation (Hall, 2010). To maintain consistency and accuracy, the research data was edited to make it clear and unambiguous. Reducing large amounts of data to manageable sizes, producing summaries, searching for patterns, and using statistical techniques are typical data analysis tasks (Cooper & Schindler, 2011).

Following receipt of completed questionnaires and interview schedules, data screening will commence with sorting, coding, and cleaning. Data sources that are incomplete will be discarded. The remaining components will be numbered and coded using a coding frame before being entered and analyzed. Descriptive statistics will be employed with respect to the dependent variable to determine and describe features of independent variables. The data collected will be edited, structured, and analyzed using IBM SPSS (2015) 26 edition statistical program software. Tables, bar charts, graphs, and figures will be used to present the data that has been analyzed. To assess the socio-economic factors affecting diversification among small-scale farmer in Uasin-Gishu County, Kenya, Binary probit model, which describes the relationship between the dependent variable and the independent variables, was used. The model is preferred to a linear probabilities model because it has more density mass than the

Binary Probit model. Additionally, the Logit model is consistent with parameter estimation with the assumption that the error term has a logistic distribution. In this study the dependent variable was the crop diversification system where "pi" = 1 if there is adoption (diversifying farmers>1) and 0 otherwise (non-diversifying farmers = 1), as shown in Equations 1 and 2.

$$P_i(Y_{it}=1)=\frac{\exp(\beta_i Z_{it})}{1+\exp(\beta_i Z_{it})} \quad \text{..... (1)}$$

$$P_i(Y_{it}=0)=1-P_{ii}(Y_{it}-1)=\frac{1}{1+\exp(\beta_i Z_{it})} \quad \text{..... (2)}$$

Where Pi (Yi = 1) is the probability of a small-scale farmer participating in crop diversification of farming (dependent variable) and "Zit" are independent variables influencing adoption in a diversified cropping system.

The specified empirical model that was used to determine the socio-economic factors influencing participation in a diversified cropping system is the Binary logit model. The dependent variable was the participation of small-scale farmers in a diversified crop system of farming (Dummy variable takes values of 0 for farmers growing less than 2 crops and 1 for farmers growing more than 3 crops) while the number of independent explanatory variables are as specified in Equation 3.

$$P_i(Y_i)=\beta_0+\beta_1x_1+\beta_2x_2+\beta_3x_3+\beta_4x_4+\beta_5x_5+\beta_6x_6+\beta_7x_7+e \quad \text{.....(3)}$$

Where Pi (Yi = 1) is the probability of a small-scale farmer adopting diversified cropping system of farming.

Where Y = adoption of crop diversification,

X1 = Gender,
X2 = Age,
X3 = Education level,
X4 = Household size
X5 = Years of experience,
X6 = Land size ,
X7 = Number of workers,

b0 to b6 are the regression coefficients and e is the error term that is normally distributed with a mean of zero and constant variance of sigma squared, e~N (0, σ^2).

4.0 RESEARCH FINDINGS AND DISCUSSIONS

The = study sought to determine the socio-economic factors affecting crops diversification among smallholder farmers in Uasin Gishu County, Kenya. Multiple linear regression model was used to analyse this objective

As seen in the table 2, the value R Square indicates the goodness of fit of the linear regression. R square is at 0.819 which means that 81.9% of the total variation in the dependent variable

(crop diversification) is attributed to the socio-economic factors and variables and the remaining 19.1% lies within the error term in the regression model for this study.

Table 2: Model Summary Results

R	R Square (R^2)	Adjusted R Square	Std. Error of the Estimate
0.842[a]	0.819	0.792	0.249

	Sum of Squares	Df	Mean Square	F	P-value (Sig.)
Regression	18.103	9	3.221	63.885	.000[b]
Residual	6.362	130	.050		
Total	24.465	139			

Source: Survey data (2024)

The overall significance of the regression model (ANOVA) was generated which yielded the results as shown in Table 2. The findings indicated that the p-value is less than the level of significance, i.e., $P<0.05$. Thus, the sample data provide sufficient evidence to conclude that the regression model fits the data which shows that the independent variables in the model improve the model fit. The F value (63.885) is calculated from the data and was compared to F critical value, $F\alpha=0.05\ (9, 139) = 3.221$. The calculated F value is larger than the critical F value ($63.885>3.221$). In this regard, the null hypothesis (H01) was rejected. Hence conclude that socio-economic factors have significant effect on crop diversification among small-scale farmers in Uasin Gishu County.

The individual regression results are shown in table 3. The result of the multiple linear regression analysis showed that age, off-farm income level, education level, land size and household size influenced crop diversification. A one-year increase in the age of the household head was found to reduce crop diversification by 11% when other factors are kept constant. This implies that as the age of the farmer increases, crop diversification reduces. This is because an older farmer is considered less energetic to supply labour to the farm. The results differ from that of Wiredu et al., (2010), who showed that in rice cultivation in Ghana, age had a positive effect on yield meaning experience in rice cultivation implied accumulated knowledge in rice production. The study is concurrent to the findings in the study done by Von Braun, Hazell, Hoddinot and Babu (2003), on achieving long-term food security in southern Africa, which found out that in terms of labour supply, the age of the household head has a negative effect on the amount of maize crop production in the sense that young people in the family households are labour providers on the farm activities and are expected to cultivate large tracts of land as compared to the older people. These findings are also consistent with the outcomes by Makate et al. (2016), who discovered that crop diversification has shown a positive relationship with the farm household's annual income.

Table 3: Multiple Regression Results on Socio-economic Factors Affecting Crop Diversification

Variables	Unstandardized β	Std. Error	Standardized B	t	Sig. (p-value)
(Constant)	-0.625	0.164		-3.820	**0.001****
Age	-0.110	0.048	-0.188	-3.116	**0.002****
Gender	0.091	0.008	-0.013	11.517	0.773
Off-farm income	0.064	0.016	0.346	4.047	**0.001****
Education level	1.578	0.486	0.231	3.860	**0.000****
Years of experience	-0.14	0.002	0.031	-6.374	0.432
Household size	0.053	0.009	0.402	5.072	**0.001****
Livestock income	-0.596	0.962	-0.036	-0.620	0.537
Land size in acres	0.237	0.080	0.588	4.872	**0.000****
Labour	-4.094	5.376	0.580	6.443	0.446

Legend
Number of observations = 139
LR Chi^2 (9) = 138.9
R^2 = 0.819
Prob >Chi^2 = 138.9
Log likelihood = 0.00
*= significant at 1% level and **=significant at 5%

Source: Survey data (2024)

Results also revealed that education level was statistically significant at 5% level with a positive coefficient of 1.877. This implies that the higher the education level of the farmer household head, crop diversification increases by 157.8%. The current study result on education levels are convergent to those of Ekou (2015) who did a study on the effects of education level on farm production in the Ivory Coast and found out that education level was significant at 1% level with a coefficient of 0.1630. Nyemeck et al., (2004) in Cameroun find that literacy level has an important effect on technical efficiency in the single-crop system of maize, but it has no impact on groundnuts production and in the associate production of groundnuts. These results show that a farmer, whose literacy number exceeds or is equal to four years, is technically more effective. These findings are similar to those of Weir (1999) who found out that in Ethiopia, that literacy level has a positive effect on cereals but it is only noticeable after a minimum of four years of training. The study results differ from those of Obierio, (2013) who found out that there is a negative correlation of -0.075 between education and maize yield in Siaya County, meaning education is negatively correlated with farm yield.

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Crop diversification and household family size were found to have a positive and significant relationship (β= 0.402). This implies that due to numerous procedures, including land preparation, sowing of seeds, planting crops, and harvesting; homes with a large family size grow a bigger range of crops. A related study by Aribi and Sghaier (2020) found that crop diversity and household size have a positive relationship, which agrees with the findings of this study.

The land size was also statistically significant at a 5% significance level with a positive coefficient of 2.37. The result of land size implies that a unit increase in land size by an acre leads to a 237% increase in food crop diversification, and this result conforms to the expected sign of the study. This means that sugarcane farmers who had large fields/farms were seen as more likely to diversify crops in their farms. This could be attributed to the fact that households with large farm sizes may want to maximize the production from their farms as they may have to combine various crops. Similar results on farm size were realized by Chiona (2011) in his study on technical and allocative efficiency of smallholder farmers in Zambia, where she reported a positive relationship between farm size and efficiency. Increasing the size of the field by one hectare increased the level of technical efficiency by 3 percent and allocative efficiency by one percent. Idumah et al., (2013) in a study in Edo State, Nigeria found that farm size was significantly positive to yam production in the area. The results of the efficiency estimation, however, indicated that farm size (1.55) was underutilized. Further, Dom et al., (2003), in a study in Nigeria, found that farm size had a positive impact on the output of flutted pumpkin and was significant at one percent level and the elasticity of production with respect to farm size was 0.71. Therefore, the current study findings are in convergence with that of Chiona (2011), Dom et al., (2003) and Idumah et al., (2013).

4.0 SUMMARY, CONCLUSION AND RECOMMENDATION

The objective of the study sought to determine the socio-economic factors influencing crops diversification among small-scale farmers in Uasin Gishu County, Kenya. Multiple linear regression was used for data analysis and the results indicated that age, off-farm income, education level, land size and family size influenced crop diversification. A one-year increase in the age of the household head was found to reduce food crop diversification by 11% when other factors are kept constant. This implies that as the age of the farmer increases, crop diversification reduces. This is because an older farmer is considered less energetic to supply labour to the farm. Results also revealed that education level was statistically significant at 5% level with a positive coefficient of 1.578. This implies that the higher the education level of the farmer household head, food crop diversification increases by 157.8%.

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CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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