EFFECTS OF NON-FARM EMPLOYMENT ON VALUE ADDITION DECISIONS AMONGSELECTED SMALLHOLDER FARMERS IN MAU-NAROK WARD, NJORO SUB-COUNTY, NAKURU COUNTY, KENYA

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DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented in this University or any other for the award of a degree.

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Recommendation

This thesis has been submitted to Egerton University's Graduate School with our approval as university supervisors.

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DEDICATION

I dedicate this thesis to my mother Emily Ooko, brother Chrispine, and my sisters; Mercy and Tracey, not forgetting my kids; Dylan, Darmian, Declan and Devan.

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ABSTRACT

Smallholder agriculture in Kenya faces challenges such as inadequate value addition and limited marketable outputs, hindering both domestic and foreign market demands. This study investigated the impact of non-farm income on value-addition decisions among rural households in Nakuru County, Kenya. The general objective of this study was to contribute to improved livelihoods through encouraging participation in non-farm employment and value addition among smallholder farmers. The specific objectives of this study were as follows: To determine the nature of value-addition activities pursued by households that earn income from non-farm sources, to determine the drivers for investment of non-farm income in value addition activities among smallholder farmers and lastly to determine the effect of non-farm income investment on value addition decisions among smallholder farmers in Mau-Narok ward, Njoro sub-county, Nakuru county. Utilizing a multi-stage sampling procedure, data was collected from 245 respondents in the Mau-Narok ward, Njoro sub-county through a cross-sectional descriptive survey. Analysis was conducted using SPSS and STATA, employing descriptive statistics, chi-square tests, the Multivariate Probit model, and Multinomial Endogenous Switching Regression (MESR). Results indicated that the average age of household heads was 43.69 years, with most participants being male (56.33%) and married (81.2%). The average farm size was 1.75 acres, and households spent approximately 6.83 hours daily on non-farm activities, earning an average monthly non-farm income of KES 23,566. Factors such as gender, age, time spent on non-farm activities, non-farm income, production level, credit access, farm size, household size, number of enterprises, and market access were found to significantly influence value-addition decisions. The MESR model revealed that participation in primary value chain activities significantly increased household income by 0.97 units. Consequently, the household total income increased for farmers adopting each value addition practice in isolation compared to those adoption a combination of the value addition activities.

Overall, these results conclude that the highest income is obtained from participation in primary value activity which is also greater than the effect of each practice jointly, suggesting that benefits are not complementary. This study concluded that non-farm income plays a crucial role in enhancing value addition, thereby boosting household income and contributing to poverty reduction and food security. Therefore, this study recommends that policymakers support farmer groups to enhance training on value addition, market opportunities, and credit access, thereby enabling smallholder farmers to make informed value-addition decisions that elevate their livelihoods.

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LIST OF ABBREVIATIONS

ATT	Average Treatment on Treated
ATU	Average Treatment on Untreated
VIF	Variance Inflation Factor
KES	Kenya Shillings
MESR	Multinomial Endogenous Switching Regression
MVP	Multivariate Probit Model
NACOSTI	National Commission for Science, Technology and Innovation
NFA	Non- farm Activities
NFE	Non- farm Employment
NFI	Non-farm Income
NFS	Non-farm Sources
SHFs	Smallholder Farmers
VAA	Value Addition Activities

CHAPTER ONE
INTRODUCTION

1.1 Background

The non-agricultural economy involves employment outside the direct crop and animal husbandry and includes activities such as services, construction, mining, commerce, manufacturing, and processing (Adjognon *et al*., 2017). Nasir and Hundie (2014) define non-farm employment as non-farm earnings from the owners' non-farm enterprises or non-farm wage earnings along with wage employment in agriculture earned on other people's farms. Such activities are often pursued through self-employment, agricultural wage labour, trades and sales, professional services, bars and restaurant, transport among others (Nagler & Naude, 2017). The contribution of these activities to household income in the developing world in general and sub-Saharan Africa, in particular, is substantial. Non-agricultural income contributes between 30% and 45% of rural household incomes in the developing world (Tetteh, 2017).

Diversification of farm income sources can be a conscious household strategy or an unintentional reaction to the crisis for the rural poor (Asfaw *et al*., 2017). Infrastructure growth and improved access to urban areas help to support more diverse livelihoods (Losch *et al*., 2013). According to Haggblade (2010), factors that motivate smallholders to participate in non-farm employment include lack of opportunities, shocks, limited land size, poor land quality, and crop failures, technology opportunities or new markets. This diversity provides profitable opportunities for those with access, and those that serve as last resort occupations for the poor (Atamanov, 2011). According to Jagdambe *et al.* (2018), the surplus labour from agriculture, especially after farm work hours, is responsible for the non-agricultural economy's success in rural areas. Previous studies have revealed that the distance to and size of nearby marketplaces influence participation in non-farm employment (Jonasson & Helfand, 2010).

Non-Farm Employment (NFE) is often seen as a diversification mechanism for rural farming households (Haggblade *et al*., 2010). However, rural non-farm employment in Africa is associated with increased household income, poverty reduction, reduced pressure on natural resources, and risk reduction (Diao *et al*., 2018). The returns from non-farm employment are invested in agricultural production in terms of buying improved seeds, purchasing fertilizers and agrochemicals, leasing extra land, buying post-harvest technologies, hiring mechanization

services, hiring and paying extra labour among others (Jagdambe *et al.,* 2018). Thus, investment in agriculture production enjoys income from both farm and non-farm sources. Income from nonfarm activities helps smallholder farmers cope with shocks and manage agricultural risks and undertake productivity-enhancing investments (Shiferaw *et al*., 2015). Much as it is true that income from agriculture can be invested in non-farm activities, Nguyen *et al*. (2021) note that in the less developed regions, farmers tend to invest the largest share of their non-farm income in on-farm activities. Previous empirical research has shown that the best approach to boost agricultural productivity, maintain food security, and reduce poverty is through the adoption of new and improved agricultural technologies. Adoption of technology in the agricultural sector has significantly reduced household poverty by improving household food security and yields (Belay & Mengiste, 2021; Habtewold, 2021).

Value addition is defined as any activity that takes a raw product a step closer to the form in which it can conveniently meet the needs of the user (Sarma *et al*., 2016). The original form of the product is transformed to satisfy consumer preferences. In the quest of finding ways of increasing farm income, much interest has been shifted towards adding value to raw agricultural products. Most agricultural raw commodities have an inherent value embedded within them. Ways in which value can be added to agricultural products include sorting, cleaning, cooling, packaging, processing, distributing, cooking, combining, churning, culturing, grinding, hulling, extracting, drying, and smoking (Mkandawire, 2018). Increased incomes, which in turn propagate the demand for foods other than starchy staples, are the main cause of this diversification (Jagdambe *et al*., 2018). According to UNCTAD (2019), value addition enables agricultural producers to access emerging global markets. This is attributed to the increase in consumer demands regarding health, nutrition, and convenience globally. However, globalization exposes rural value-added products to quality standards requirements which put them at risk of being excluded (Haggblade *et al*., 2010).

Value addition is also associated with the provision of new outlets for agricultural products, increased income, creation of employment, and reduction of wastage. Apart from adding value to agricultural commodities, it also makes the products more tradable than they would be otherwise (Soyres, 2018). Thus, value addition is an important aspect as far as rural development is concerned. Smallholder agriculture is characterized by a lack of sufficient value addition and a failure to fulfill expanding domestic and international market demands (Ssebatta

et al., 2014). Due to the challenges, they confront, farmers are unable to produce sufficient quantities and quality to be marketable and financially viable (Orinda, 2013). Lack of adequate facilities for storage and processing, a dearth of skilled labor, restricted access to credit, and information asymmetry all pose problems. Additionally, there is a lack of information and poor access to commercial services, which makes it difficult to make informed decisions about purchasing goods and services (Ayoo, 2019). These restrictions prevent farmers from participating in the agricultural value chain and satiating both domestic and international markets (FAO, 2017). Participation of smallholder farmers in NFE is frequently considered a diversification strategy as well as a way to get over these restrictions. Reducing the obstacles small-scale farmers confront will increase their competitiveness and support the development of the agricultural sector (Haggblade *et al.,* 2010).

Income from non-farm sources (NFS) is often invested in agriculture at all nodes of the value chain resulting into higher marketable surplus (Jagdambe *et al.,* 2018). The study of the relationship between rural nonfarm employment and agriculture is largely concerned with agricultural productivity. Studies show that participation in NFE is positively correlated with increase in agricultural productivity (Adellekan & Omolayo, 2017; Shilpi & Emran, 2016; Takeshima *et al.,* 2018; Tetteh, 2017). While studying rural non-farm incomes in developing countries, Haggblade *et al*. (2010) noted that there's a correlation between income diversification in non-farm activities (NFA) and an increase in opportunities for value addition. According to Jadgambe *et al*. (2018), participation in non-farm employment by rural households has a significant influence on agricultural commercialization. Adjognon *et al*. (2017) note that nonfarm employment is welfare-improving and poverty-reducing.

Much as non-farm employment in rural Sub-Saharan Africa acts as an important source of income for rural agricultural households, it influences several agricultural and non-agricultural decisions among farming households. Non-farm employment has been studied for decades in relation to its ability to improve rural welfare and reduce poverty (Danso-Abbeam *et al.,* 2021; Djoumessi *et al.,* 2020; Dzanku, 2019; Gansonre, 2021; Janssens *et al.,* 2019; Michailidis & Lazaridou, 2020; Synder *et al.,* 2019; Toit, 2019). Much of the research in developing countries has largely focused on impact of non-farm employment on agricultural productivity. Despite the importance of non-farm employment among rural farm households' decisions, there is limited information about the effect of such activities on value-addition

decisions. Therefore, a critical analysis of the link between rural non-farm employment and value addition decisions is important to improve the response mechanisms related to food security, livelihood improvement and most importantly poverty alleviation.

1.2 Statement of the problem

The contribution of non-farm activities to household income in Sub-Saharan Africa is substantial and has increased over time. This has occurred at a time when the promotion of value addition among agriculture smallholder households is at its peak. Consequently, several independent studies in relation to non-farm employment and value addition activities have been conducted such as determinants of participation in non-farm employment, the impact of non-farm employment on smallholder farmers' welfare, and the determinants and effects of value addition on household income respectively. Moreover, a review of non-farm employment in Kenya shows that non-farm activities are often seen as an income diversification mechanism for rural farming households. While separate literature exists on non-farm employment and value addition in agriculture, none of such studies have discussed the link between participation in non-farm employment and value addition decisions. This study, therefore, aimed at closing this information gap by determining the effect of non-farm employment on the value addition decision among smallholder farmers in Mau-Narok ward, Njoro sub-county, Nakuru county, Kenya.

1.3 Objectives of the study

1.3.1 General objective

To contribute to improved livelihoods through encouraging participation in non-farm employment and value addition among smallholder farmers.

1.3.2 Specific objectives

i. To determine the nature of value-addition activities pursued by households that earn income from non-farm sources Mau-Narok ward, Njoro sub-county, Nakuru county.
ii. To determine the drivers for investment of non-farm income in value addition activities among smallholder farmers in Mau-Narok Njoro ward, sub-county, Nakuru county.
iii. To determine the effect of non-farm income investment on value addition decisions among smallholder farmers in Mau-Narok ward, Njoro sub-county, Nakuru county.

1.4 Research questions

i. What is the nature of value-addition activities pursued by households that earn income from non-farm sources Mau-Narok ward, Njoro sub-county, Nakuru county?
ii. What drives the investment of non-farm income in value addition activities among smallholder farmers in Mau-Narok ward, Njoro sub-county, Nakuru county?
iii. What is the effect of non-farm income investment on value addition decisions among smallholder farmers in Mau-Narok ward, Njoro sub-county, Nakuru county?

1.5 Justification of the study

Through its income effect, non-farm employment helps farmers to have opportunities to invest in more advanced agricultural technologies that make rural households financially secure and encourage transition from traditional to modern agriculture. This study aimed to contribute towards the achievement of the second Nakuru County Integrated Development Plan objective of increasing agricultural value addition, farm mechanization and increasing productivity (Nakuru County Government, 2018). It also sought to provide the youth with opportunities for work that are productive and deliver fair income, furthering better prospects for personal development and social integration through security in the workplace and social protection thus contributing to the Kenya Youth Development Policy 2019. Since this study aimed at describing the relationship between non-farm employment and value addition, it leaned towards the achievement of the three anchors of Agricultural Sector Transformation and Growth Strategy (ASTGS 2019-2029) which are increasing small-scale farmer incomes, increasing agricultural output and value addition, and boosting household food resilience. Kenya Vision 2030 seeks to transform Kenya into an industrializing economy with agriculture contributing 10% to that level of industrialization which is in line with value addition activities.

Furthermore, this study sought to contribute to the fulfilment of the national food security and nutrition strategy, which aims to enhance the amount and quality of food available, accessible, and affordable to all Kenyans at all times (GoK, 2011). This study's findings back The Kenya National Agribusiness Strategy, which seeks to steer the agricultural sector's growth and change from a subsistence-based approach to one that places a renewed emphasis on profitability and market demands. The documentation about the transformation of rural economies by the study also contributed towards realizing the first pillar of Africa Agenda 2063, which intends to depend on modern agriculture for scaled-up production, improved productivity

and value addition. The study contributed towards Sustainable Development Goals, 1 – End poverty and 2 – Zero hunger since participation in Non-Farm Employment and Value addition activities pursued by smallholders aim at ending poverty and reducing vulnerability to hunger.

The study's findings are aimed at increasing policymakers' awareness of how non-farm income-generating activities affect value addition decisions, which in turn affects rural households' standards of living. This includes policymakers in the government, donor organizations, and development organizations.

1.6 Scope and limitation

This study focused on smallholder farmers within Mau Narok ward located in Njoro sub-county in Nakuru County. It also focused on non-farm activities such as self-employment, agricultural wage labour, trades and sales, artisan, agro-processing, extractive, and services among smallholder farmers. Lack of record keeping since the survey depended on recall. This was mitigated through probing. Most of the household heads who participate in non-farm employment worked outside their farms and homesteads thus locating them posed a challenge. To overcome this obstacle, appointments were scheduled on time and repeated reminders sent out to the respondents until the interviews were conducted. The generalization was based on the characteristics of the smallholders in the study area. Other smallholders in other areas with the same characteristics were likened to the study's results.

1.7 Definition of terms

Agriculture wage labour: Women and men who work in orchards, crop fields, and livestock units. In this study the term refers to rendering labour in another farm other than your own.

Agro-processing: In this study, agro-processing refers to a non -farm activity, is seen as a source of income/employment for the person participating in such an activity.

Diversification: This is a risk reduction technique that allocates investments across various, industries, financial instruments and other categories. In this study it refers to engaging in other activities besides farming to earn extra income.

Employment: This the process of utilizing, making use of something/someone or putting something/someone into service. In this study the term has been used to mean the utilization of nonfarm activities in value addition to earn more income.

Enterprise: An enterprise in this case is defined as a component of crop farming that a farmer is undertaking.

Formal employment: This involves written contractual agreement between an individual employee and the employer. In this study, formal employees include nurses, teachers, lawyers, ministers, accountants, bank agents, industrial engineers and all professional workers as per the definition.

Non-farm employment: involves activities outside the direct crop and animal husbandry and includes activities such as services, construction, commerce, manufacturing, and processing excluding formal employment. In this study it refers to agro-based activities other than farming that a farmer engages in to earn extra income/ diversify their income.

Non-farm income: refers to the portion of farm household income obtained off the farm. In this study it refers to income that smallholder farmers earn from participating in activities that are agro-based.

Off-farm employment: off-farm employment is much broader than non-farm employment and it is made up of agricultural wage income plus non-farm income.

Self-employment: is the state of working for oneself rather than an employer.

Trade and sales: Refer to activities that involve transfer to a customer of goods in exchange for payment occurring in retail stores, trading centers, homesteads, sidewalk sales, farmers' markets, flea markets, and restaurants. In this study it refers to activities that involve transfer of agricultural products in exchange for payment.

Value addition: is defined as any activity that takes a raw product a step closer to the form in which it can conveniently meet the needs of the user. In this case value addition involves creation of additional value at a particular stage of production to increase the economic value of an agricultural commodity.

Value chain refers to a chain of activities, that transform raw materials into other forms that can be purchased by a final user. A value chain is characterized by the series of production which include; provision of inputs, primary production, intermediary trade, processing, marketing, final consumption and, the quality of linkages and coordination between business partners in the value chain.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction to non-farm employment

Non-farm pursuits are more crucial to rural poverty alleviation and sustainable development in most developing countries (Woldeyohannes *et al*., 2021). There are several definitions of non-farm employment. One is the involvement of employment outside the direct crop and animal husbandry and includes activities such as services, construction, mining, commerce, manufacturing, and processing (Adjognon *et al*., 2017). According to Nasir and Hundie (2014), NFE involves earnings from the owners' non-farm enterprises or non-farm wage earnings along with wage employment in agriculture earned on other people's farms. Such activities are often pursued through self-employment, agricultural wage labour, trades and sales, professional services, bars and restaurant, transport among others (Nagler & Naude, 2017). It constitutes a significant share of rural household income across Sub-Saharan Africa (World bank, 2018). The contribution of these activities to household income in the developing world in general and sub-Saharan Africa in particular is substantial. Non-agricultural income contributes between 30% and 45% of rural household incomes in the developing world (Tetteh, 2017). This study considered non-farm income as a portion of farm household income obtained off the farm.

According to the findings of Woldeyohannes *et al*. (2021), they elucidated that the rural economy can be impacted by non-farm activity in a number of ways. First off, work outside of agriculture eases the demand for land in underdeveloped areas. As a result, non-farm pursuits can aid in ending the destructive cycle of "poor – extensive cultivation – ecological deterioration – poverty." Secondly, the revenue derived from non-agricultural pursuits has the potential to considerably augment the overall household income, hence augmenting the investment potential in agricultural endeavors. Additionally, it can reduce variations in revenue and facilitate the adoption of some more profitable but "risky" agricultural technologies that support the transition from traditional to modern agriculture. Third, they went on to conclude that non-farm revenue frequently serves as a source of savings, which is crucial for reducing poverty. Households that engage in non-farm activities to diversify their sources of income are better equipped to weather economic downturns. Additionally, lack of available land, seasonality in agricultural output means that workers in rural areas cannot be hired year-round, necessitating the widespread development of non-farm enterprises (Woldeyohannes *et al*., 2021).

Cunguara *et al*. (2011) found that farm households in Mozambique engage in non-farm employment as a coping strategy when faced with drought. Farm households engage in NFE in order to meet both farm and non-farm expenditures (Djurfeldt, 2012). Mathenge and Tschirley (2015) argued that smallholder farmers view non-farm employment as a long-term strategy to deal with anticipated weather risks. Farmers in Ethiopia were found to participate in NFE with the intention of achieving income growth (Bezu *et al.*, 2012). Households that are unable to generate enough food to meet their own requirements from the farm engage in NFE to top up farm income (Tetteh, 2017). Other reasons for engagement in NFE by smallholder farmers include limited access to production inputs, better payment in non-farm employment, low income from agricultural activities, the need to mitigate risks in production, declining farm productivity and the growing opportunities within the rural non-farm sector (Tetteh, 2017).

Non-farm employment is often seen as a diversification mechanism for rural farming households (Haggblade *et al*., 2010). It provides smallholders with income to invest in new production technologies and farm inputs thus enhancing the productive capacity of farm activities. The income is equally used in hiring extra land, buying post-harvest technologies, hiring mechanisation services, hiring and paying extra labour among others (Jagdambe *et al*., 2018). Income from non-farm employment supplements on-farm income thus improving the household welfare and the food security status of rural households (Tetteh, 2017). Rural non-farm employment in Africa is associated with increased household income, poverty reduction, reduced pressure on natural resources, and risk reduction (Diao *et al*., 2018). Income from diversifying into nonfarm activities helps smallholder farmers (SHF) cope with shocks and manage agricultural risks and undertake productivity-enhancing investments (Shiferaw *et al*., 2015). The participation of farm households in NFE is a major decision that has implications for farm output and productivity in many developing countries. It has been established that income from NFS is invested in many activities such as value addition (Jadgambe *et al*., 2018; Tetteh, 2017).

2.2 Introduction to value addition

Over ten million Kenyans suffer from chronic food insecurity and undernourishment, and two to four million individuals are in constant need of emergency food assistance. Micronutrient deficits are common, with about thirty percent of Kenyan youngsters categorized as undernourished. The government's objective is to ensure that all Kenyans have access to safe food in adequate quantities and quality throughout their lives to meet their nutritional needs and maintain optimal health (GoK, 2011). Many experts now concur that the growth of the agricultural sector can effectively address several sustainable development goals, such as SDG1 (poverty), SDG2 (hunger), SDG3 (well-being and health), SDG10 (reduction of inequality), and SDG12 (consumption and production). Various governments and development organizations view agricultural technologies as a workable solution to raise farm and agricultural sector production. Many agricultural technologies are currently being adopted globally; however, the local agricultural environment and culture play a major role in determining which technologies are embraced where they are used (Ruzzante *et al*., 2021).

A number of studies carried out in Kenya and other parts of the world have indicated that agricultural technologies have the potential to significantly reduce poverty. For instance, it has been discovered that using alternative farming technologies greatly increases yields, farm income, household consumption, improves nutrition, and generally raises household wellbeing (Shita *et al*., 2020; Wordofa *et al*., 2021). Value addition plays a significant role in improving the livelihood of small-scale farmers (Mmasa, 2015). According to Parcel *et al*. (2021), farms can add value or change the physical state or form of agricultural commodities and products in different ways to enhance an agricultural commodity’s value. Smallholders pursue value addition in order to earn higher revenue from agricultural produce, create a loyal market around their products, improve the shelf life of products, and increase the bargaining power of producers (KAAA, 2016). Agric Technical Working Group Partners (2022) argued that smallholders add value to agricultural products to make farming profitable, reduce post-harvest losses, reduce import or meet export demands, diversify the economic base for rural communities, labour saving, access more markets, and preserve food.

2.3 Socio-economic characteristics of smallholders participating in non-farm employment and value addition

With refence to the findings of Nkurumwa *et al*. (2017), getting to understand the socio-economic characteristics of smallholder farmers is vital as it's the basis for alleviating the shortcomings that these farmers go through. Consequently, they need to be given a lot of consideration in instances where these conditions are below standard, the probability of these farmers participating in developmental endeavours is likely to be minimal. According to Nagler and Naude (2017), non-farm enterprises in six Sub Saharan countries of Ethiopia, Malawi, Niger, Nigeria, Tanzania and Uganda are operated by farm households across rural Africa as small informal businesses contribute to a significant share of household income. They do not create urgently needed jobs, tend to perform less well than urban-based enterprises, and tend to be less dynamic. Yesuf (2015) used Probit and logit models to reveal that households that engage in non-farm activities in Ethiopia are those with large herds of cattle and productive assets or resources. These act as capital when sold to start up a non-farm economic activity and can act as collateral security for a household to access loans from commercial banks.

Diao *et al*. (2018) posited that households that participate in NFE in Tanzania tend to be younger and better educated. They attribute this to the fact that having a formal education is required to attain certain jobs in rural areas. They also noted that households that participate equally have access to daily public transportation systems and most operate informally. The main source of income for running rural enterprises was the owners' personal income though, for most, NFE was the main source of income. Other than agricultural work, participation in NFE was the only form of primary employment for such households. The authors further established that most of the households that participate in non-farm employment had mobile phones, access to electricity, informal financial services, were members of cooperatives or associations and had access to weekly markets. In a study carried out in Ghana by Tsiboe *et al.* (2016), all households participating in NFE were close to the main road. The authors posited that young households tended to diversify into NFE due to their charisma and energy to engage in more than one activity at a time while for the older households' participation in NFE was due to their experience, skills gained in running different activities and the linkage with the community and other service provider.

According to Yesuf (2015), participation in NFE in Ethiopia was influenced by the gender of the household head since men are generally expected by society to provide for their families. Thus, males were the main participants in non-farm activities in rural areas compared to their female counterparts. He further argued that households that have educated household heads participate more in non-farm activities compared to non-educated households. This is attributed to the fact that individuals with a higher level of education always search for wage employment in non-farm sector. In a study carried out in Nigeria, households that participated in NFE had access to the markets for non-farm products (Babatunde & Qaim, 2010). This allowed them to participate in income-generating activities in the nearest trading centers. The shorter distance to such markets influenced smallholder farmers to diversify in NFA. Shehu and Sidique (2013) reported that households participating in NFE had access to credit and finance from various sources in a study carried out in rural Nigeria on the impact of NFE on household welfare.

Mundowa *et al*. (2020) identified low land productivity as a feature that cuts across most of the households participating in NFE in Zimbabwe and it is associated with low output. Thus, to boost the income from low agricultural productivity, such households seek wage employment in non-farm sector. This allows them to supplement food as well as household income. Mundowa *et al.* (2020) in their study in Zimbabwe posited that households that engaged in NFE had larger family size as this households had high demand for food and income to be able to sustain the household. The authors hypothesized that these households had to diversify their income sources which could not be met through agricultural production due to the seasonality and subsistence nature of rural agriculture. The authors noted that this was common in households that the consumer to worker ratio was highest and in instances where most of the household members had not reached a labour productive age.

2.4 Drivers for the investment of non-farm income in value addition

The main challenge associated with smallholder farming is low productivity coupled with limited value addition which limits agricultural producers' profitability and the vibrancy of the overall economy (Langyintuo, 2020). The adoption of better production methods and value addition has been limited by weak value chain linkages and limited support from the government. To benefit from commercialization and liberalized markets, smallholders ought to benefit from local-level value addition and be exposed to competition (National Planning Authority, 2022). Value addition in this case involves creation of additional value at a particular

stage of production to increase the economic value of an agricultural commodity (Agrmc, 2022). Broadly, it may involve changing a products form, time and place to a more preferred form (National planning Authority, 2022). Examples include turning mangoes and apples into juice, bananas into crisps, maize into flour. This is often achieved through processing, cooling, pasteurization, drying, packaging, extracting or any other process that changes raw agricultural commodities into new products (Agric Technical Working Group, 2022).

While farmers put a lot of effort in their crops or livestock, they tend to get the least out of it when it comes to marketing. Farmers have long been very comfortable with the way they handle food where excess food that gets spoilt is immediately thrown away (KAAA, 2016). Value addition can thus act as an avenue to reverse this unfortunate situation. Agricultural value addition can take various levels and forms from basic to sophisticated forms like packaging, processing, cooling, drying, extracting, or differentiating products from their raw forms (National Planning Authority, 2022). Value addition transforms unprofitable enterprises into profitable ones thus ensuring the long-term survival of smallholder farming (National Planning Authority, 2022). The planning authority argues that agricultural value addition is very critical in transforming the country from a peanut to a developed and prosperous nation. SHFs are motivated to engage in value addition to make farming profitable, provide better and safer products for human consumption, command high product prices, minimize post-harvest losses, meet the demands and standards of export markets, make more money through labour saving (Agric Technical Working Group, 2022). Country governments promote value addition in order to diversify the rural economy and increase foreign exchange earnings. Value addition in form of food preservation is done to reduce losses as a result of perishability and seasonality by extending shelf life, reducing wastage of surplus produce, retaining nutritional value of food products, improving food flavours and preserving food products (Agric Technical Working Group, 2022).

Using the multinomial Probit model Diao *et al*. (2017) found that smallholders and rural dwellers invest income from the non-farm economy because of various reasons. The reasons are the presence of a market opportunity compels investment mainly in manufacturing and trade services, the presence of capital that has been accumulated, and prior experience of individuals before settling in rural areas or into smallholder farming. Nagler and Naude (2017) employed a Probit model to posit that individuals invest proceeds from NFE to earn an income during the

lean season, low incomes from agricultural production, need to mitigate shocks, household desire to maintain consumption during risky periods, limited social security, loss of employment, growing family size that offers a source of labour, pressure on agricultural land.

Khan *et al.* (2022) used unconditional quantile regression model to reveal that smallholders invest income from non-farm employment to sustain the adoption of new farming technologies, enhance household incomes, enhance food security and limit household poverty levels, save for labour during the harvesting period, pay for insurance, enhance accessibility to credit and insurance through formal and informal sources. Woldeyohanes and Surry (2017) used a double hurdle model to report that individuals invest non-farm income due to the presence of microfinance institutions to supplement their savings, thin and unavailable credit markets, it is invested in agriculture to increase productivity and marketable surplus, need to be self-employed and need to invest in high-value cropping. Basing on the studies cited above, investment and usage of income from non-farm income has been studied widely, however, none of the studies has focused on motivation of investment of such income. Furthermore, studies have not given attention to investment of non-farm income in value addition activities.

2.5 Effects of non-farm employment on value addition decisions

The contribution of non-farm employment to household income in the developing world in general and sub-Saharan Africa, in particular, is substantial. Non-agricultural income contributes between 30% and 45% of rural household incomes in the developing world (Tetteh, 2017). The percentage is thought to be 58% on a worldwide scale. Participation in non-farm employment is a recurring phenomenon, and dependence on NFE is anticipated to rise (Chang & Wen, 2011). In many developing nations, on and off-farm jobs complement each other and can be advantageous for the agricultural sector. As an illustration, it's usual for farm households to invest their earnings from non-farm sources back into their farming endeavors and the opposite is also true. While money from farming can be invested in businesses, income from NFE can help with the purchase of farm inputs or the adoption of new technology. Due to this, the two sectors in many developing nations have backward and forward connections (Tetteh, 2017). However, the linkage between investment of non-farm income in agricultural value addition activities has not received attention from researchers.

According to Maligalig *et al.* (2019), most farming households are faced with multiple investment decisions. Much of farming households make decisions related to which agricultural

inputs to purchase, however, decisions to invest income from NFE are also among the decisions that are made. They argued that the decisions made by farming households on how to use returns from NFE are largely influenced by socioeconomic, demographic, and institutional factors. Bezo (2013) reported that wage payment and returns from skilled wage employment are always three times higher compared to returns from unskilled wage employment while returns from low investment businesses are two times lower compared to the high investment business. He further revealed that returns from unskilled wage employment which is the least paying are almost close to or the same as returns from farm wage employment.

The returns from non-farm employment are invested in agricultural production in terms of buying improved seeds, purchasing fertilizers and agrochemicals, hiring extra land, buying post-harvest technologies, hiring mechanisation services, transportation of produce, hiring and paying extra labour among others (Jagdambe *et al.,* 2018). Transportation of produce and the use of post-harvest technologies on agricultural produce are forms of value addition. Revenue from NFA in East Africa was found to increase the likelihood of households engaging in commercial activities such as the distribution of products which is a form of value addition (Kinuthia *et al*., 2018). According to Woldeyohanes *et al*. (2015), revenue from NFS allowed smallholders to invest in agricultural practices that increased productivity and reduced exposure to production risks. NFE is associated with expanded access to finance and information and decisions on how to overcome risk restrictions (Yang *et al*., 2016). Revenue from NFS is associated with decisions to modify production scale, purchase social services, and improve productive capacities (Chang *et al*., 2022). Tetteh (2017) argued that revenue from NFS is invested in non-farm pursuits such as the purchase of domestic goods. Generally, research has largely focused on investment of non-farm income in agricultural production activities. A linkage between non-farm income and value addition decisions is still lacking.

To revitalize rural communities, investment in value addition is one of the main recommendations that development institutions always advocate for (Ayoo *et al.,* 2019). Diao *et al.* (2018) reported that participation of households in NFE was associated with increased sales of value-added products in Tanzania. Haggblade and Reardon (2010) noted that an increase in incomes from NFS is associated with increased demand for rural transport services required to move agricultural produce from one point to another. They further note that some NFA, initially undertaken part-time by farm households for self-consumption, spin-off as separate full-time

commercial activities such as mechanical grain milling and food distribution which are forms of value addition. Do *et al.* (2021) reported that a higher income from NFA in Vietnam such as self- and wage-employment generates a larger opportunity cost for rural households to participate in plant extraction activities. Where value addition is mentioned, it only comes as a recommendation for further improvement of incomes from non-farm activities. The relationship between value addition as a recommendation for improving incomes from non-farm activities is not known.

Maligalig *et al*. (2019) revealed that participation in NFE in Malawi was associated with an increased likelihood to use agro-inputs such as inorganic fertilizer and investment in other yield-enhancing technologies. Thus, NFE influenced the decision to invest in the purchase of inputs such as fertilizer. However, returns from NFE were found not to affect decisions related to agricultural investments and instead affected labour allocation decisions (Adjogonon *et al*., 2017). Bezu (2013) analyzed the decision among rural households in relation to skilled wage employment, unskilled employment, and high investment business. He found out that returns from NFE are likely to be invested in activities and services that bring higher returns to the farming household. He also noted that in case there are services or non-farm products that are highly demanded in a given region, income from NFE is likely to be invested in such services or activities. This is due to the perceived market and profits that accrue from such business ventures.

According to Anriquez and Daidone (2010), potential direct effects from non-farm income are liquidity relaxing and lost-labour effects. Liquidity relaxing effect is associated with a potential increase in investment while lost-labour effect is related to allocation of labour off-farm. They noted that engagement in NFA was associated with increased investment in farm inputs in Ghana's rural economy. Income from NFS was found to increase agricultural output in Northern Ethiopia (Gebregziabher *et al*., 2012). Both studies agree nonfarm income increased investment in field inputs since participating households become free from credit restrictions which increases spending on farm inputs. Results from Wang *et al*. (2011) corroborate with the two studies where they concluded that non-farm revenue has a positive impact on agricultural output. However, the impact of non-farm income on the decision to add value on agricultural produce is still unknown.

2.6 Theoretical framework

2.6.1 The rural livelihood model

This study considered a risk-averse household which comprised of smallholders engaging in both on-farm and nonfarm activities. The returns from each of the activities considered are not perfectly correlated and not very certain. The household thus has to decide on how to allocate income earned previously from non-farm sources. The cash from non-farm sources can be spent on input purchases, hired farm labour, invested in value addition or an off-farm enterprise (Mathenge & Tschirley, 2015).

To understand the decision to diversify rural household income, this study adopted the rural livelihood model as modified by Vasco and Tamayo (2017) from Ellis (1999). Rural households tend to venture into activities such as value addition to maximize their income returns though the decision is subject to cash, technology, and time available. The model further explains that diversification is a function of returns to labour time spent on activities on-farm in comparison to off-farm employment. Basing on the amount of income earned from NFS and the time available, a household chooses which activities to invest in. Among the activities to invest in may include VAA. Other factors that the household bases on to invest in activities such as value addition include physical capital, human capital, financial capital or its substitutes, and social capital.

2.6.2 Modern portfolio theory (MPT)

Livelihood diversification according to Modern Portfolio Theory (MPT) implies market risk reduction through investment in several instruments with imperfectly correlated returns. In deciding where to invest income from non-farm into agricultural ventures, the conceptual model depicts how the expected returns by household farms may be correlated with their present portfolio. Households that are risk-averse prefer portfolios with ventures whose individual returns are negatively correlated.

The ideal portfolio is a trade-off between anticipated returns and related risk because diversification does not completely remove variation (Markowitz, 1952). Marginally, a household's propensity to invest NFI into value addition will depend on 1) the expected returns from value addition (and their variance) as determined by socioeconomic conditions and the household's business' aptitude, and 2) the correlation between those returns with the current portfolio; of particular interest here is the kind of off-farm activity is in the portfolio and its

association to farm activities. NFA may be different relatively in the risks and returns, but more importantly, how they relate to other investment activities, which suggests that the likelihood that the proceeds from these activities will be used to fund agricultural investments may vary depending on the type of off-farm activity. Given a risk preference, a given portfolio composition may result in a given degree of risk premium and, thus, a given impact on value addition.

This study explored the potential impacts of various non-farm activities based on their stability and correlation with value. Among the broad NFA to be considered include, remittances, and other business and service activities. Remittances are categorized heterogeneously due to income volatility of received income by recipient households from this source depending on the characteristics of the sender, including their association with the household, as well as the nature and location of the activities they engage in. To facilitate investment in agriculture and value addition, a salaried head of household who lives away from the family might regularly remit bigger amounts. The low association of such earnings with local agriculture may also indicate potential reinvestment behaviour into agriculture, given that remittances may result from an intentional strategy of migratory labour to distribute risk over space. The anticipated impacts of this category remain an empirical inquiry because of limited knowledge about the remitter and the activities they engage in. However, can assume that remittance revenue from urban wage work is utilized to finance farming activities, leading to a rise in agricultural incomes.

Service activities and other business: Agriculture earnings (usually seasonal, low-paying labour on nearby farms), service, manufacturing, and trade are only a few of the activities included in this division. There may be a variation in activities that are categorized specifically in terms of riskiness, anticipated returns, and the connection to agriculture, but generally speaking, earnings from these activities are expected to have lower stability than remittances. Additionally, because they are more likely to be influenced by regional demand, returns are anticipated to be associated with those of the area's main source of revenue. Therefore, it is reasonable to anticipate that the amount of money reinvested from these activities into farming will rise as 1) the percentage of off-farm earnings in the household's total cash income and 2) the anticipated returns from farming as estimated by the agricultural potential of the area. The net impact of

these opposing forces becomes an empirical matter, too, because low potential locations (those with low predicted returns from farming) frequently have significant shares of non-farm income.

2.7 Conceptual framework

This study theorized interrelationships, the major contributing factors, and their interrelationships. Smallholder farmers do a blend of farming and non-farming activities. The non-farm sector has been proven to exert positive externality on the development outcome of the rural population. This study considered non-farm activities that were grouped into five categories The ventures included trades and sales (Agrovet, Grocery stores, dealing sisal ropes/ firewood, Livestock trading, Timber selling), Artisan (Basket weaving for carrying agricultural goods), service (Harrowing, harvesting, spraying, transport of agricultural goods), extractive (Wood cutting/ lumbering) and agro-processing (Posho mill). Non-farm employment in turn generate income for the smallholder farmers which holds the tendency to increase the average household income. The assumption was that some farmers would invest the income earned from non-farm sources in different activities including value addition. The Value Addition Decisions (VAD) that smallholder farmers can make were assumed to be three. They included primary processing (drying, sorting, cleaning and storage), secondary processing (milling, grinding, hulling, extracting) and tertiary processing (distribution, cooking, packaging, branding and grading). The decision to add value was influenced by a number of factors discussed as follows.

Profit maximization, type of enterprise that smallholders engage in, production level, access to credit, need to provide better and safer products for human consumption. When products meet the above qualities, they command higher prices. Farmers were motivated by the urge to minimize post-harvest losses as a result of surplus production or lack of markets for their produce. The need to access more markets encouraged smallholder farmers to add value to their products so as to reduce wastage of surplus produce, retain nutritional value of food products, improve food flavours and preserve food products. Engagement in either primary, secondary and tertiary processing depended on the income level of the household. Therefore, it was anticipated that the level of value addition would have an impact on several important household livelihood outcomes, like food security. Value addition was anticipated to boost farm income, enabling the household to lessen poverty. We eventually anticipated seeing disparities in living standards, with farmers who decided to add value having higher utility and hence differing poverty status as depicted in Figure 2.1.

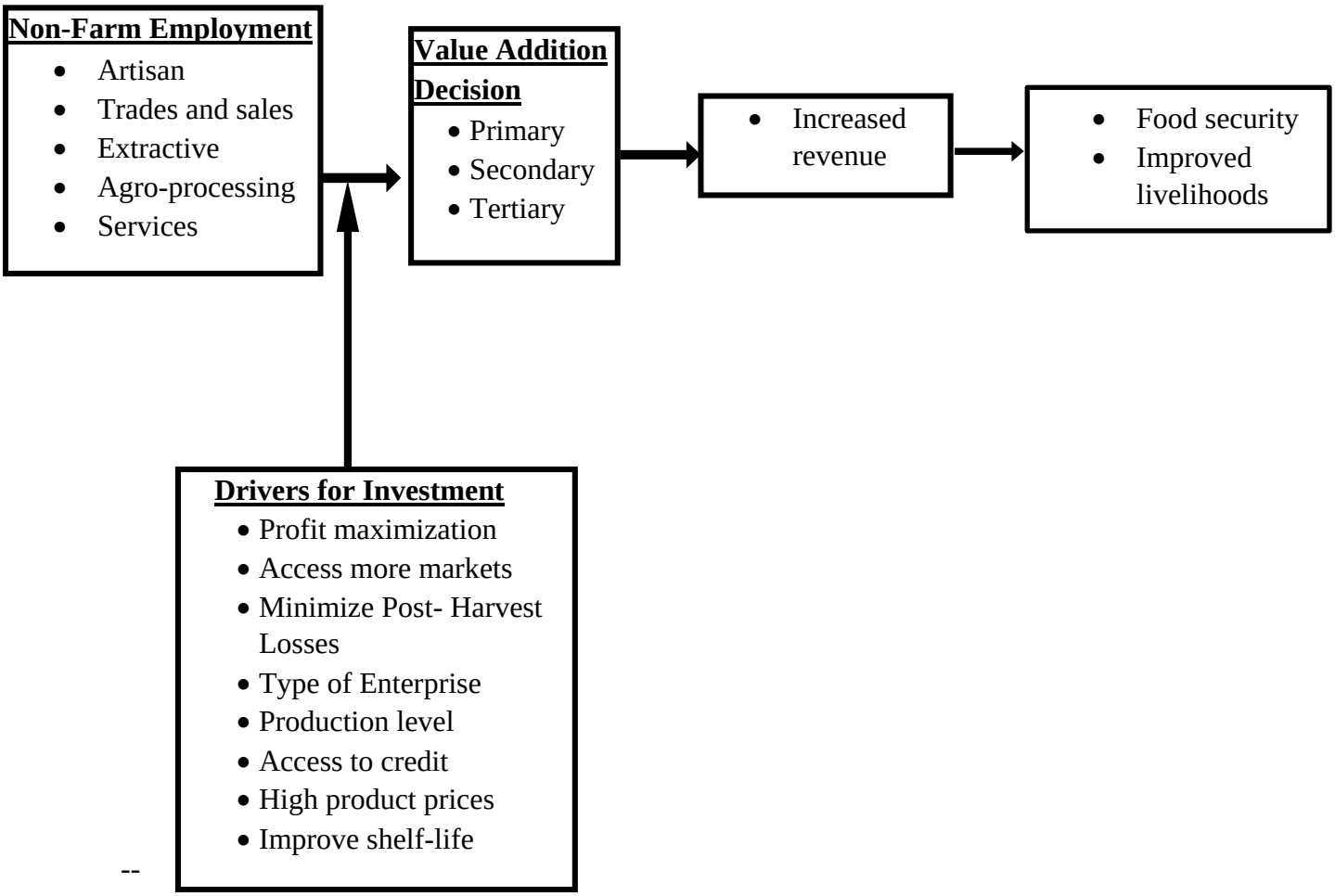

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Figure 2.1: Conceptual framework

CHAPTER THREE
METHODOLOGY

3.1 Study area

This study was carried out in Kenya's Rift Valley, in Njoro Sub-County of Nakuru County. The sub-county was founded in December 2008 after being curved out from Molo sub-county. It is bordered to the north by Rongai Sub-County, to the east by Nakuru and Naivasha Sub-counties, to the south by Narok County, and to the west by Molo and Kuresoi Sub-counties. Njoro Town, which is 18 kilometers west of Nakuru Town and roughly 177 kilometers northwest of Nairobi, is where its headquarters are located. Njoro, Kihingo, Mauche, Lare, and Mau Narok make up the Sub-Five County's administrative sub-divisions as shown in Figure 2. (Molo District Development Plan, 2008–2012, Page 28) Between 0° 13° South and 1° 10° South, and 35° 28° and 35° 36° East, are the latitude and longitude of the Sub-County. The population was 238,773 (Males – 118,361 and Females – 120,408) as of the 2019 census, covering an area of 702.1 square kilometers. With the Makalia and Njoro Rivers across it, Mau Forest's western block is included in the Sub-County.

Njoro sub-county was chosen due to the fact that at least 80% of the population is employed in the informal business sector, Njoro has a sizable informal economy (Symbiocity 2018). These unofficial businesses are centered on street hawking, open-air market, and transportation, primarily Boda Boda. Emerging towns and residential estates offer opportunities for farmers to engage in non-farm activities. There is a growing urban population in Njoro and due to its close vicinity to Nakuru Town, the town's economic growth has improved. Njoro sub-county was also selected on the basis of its access and proximity to the researcher.

Njoro sub-county has developed into a significant hub for agricultural development, education, and research over the years. Egerton University is located 5 kilometers south of the town's center, and the Kenya Agricultural and Livestock Research Organization (KARLO) also has a campus there. Large-scale land holdings are a feature of the rural environment. The main industries in the area are dairy, vegetable, horticulture, wheat and barley farming. The existence of various institutions and the emergence of developmental non-agricultural activities within Njoro sub-county has offered the predominantly farming community to engage in NFA alongside farming activities.

Mau Narok is one of the wards in Njoro located on South East of Njoro town. It is known for agriculture where locals mostly grow cabbages, potatoes and tomatoes. Majority of the people who live there are Maasai, Kikuyu and Kalenjins. Mau-Narok is a horticultural hub, the small pieces of land are fully utilized for horticultural activities with little or no room left for other activities. This resonates with the fact that in Kenya, the percentage of households undertaking farming as well as non-farm activities is estimated to be around 90% (Jaetzold *et al*., 2012). In fact, at least 80% of the population in Njoro Sub County is employed in the informal business sector, thus being in Njoro sub county, Mau-Narok has a sizable informal economy (Symbiocity, 2018).

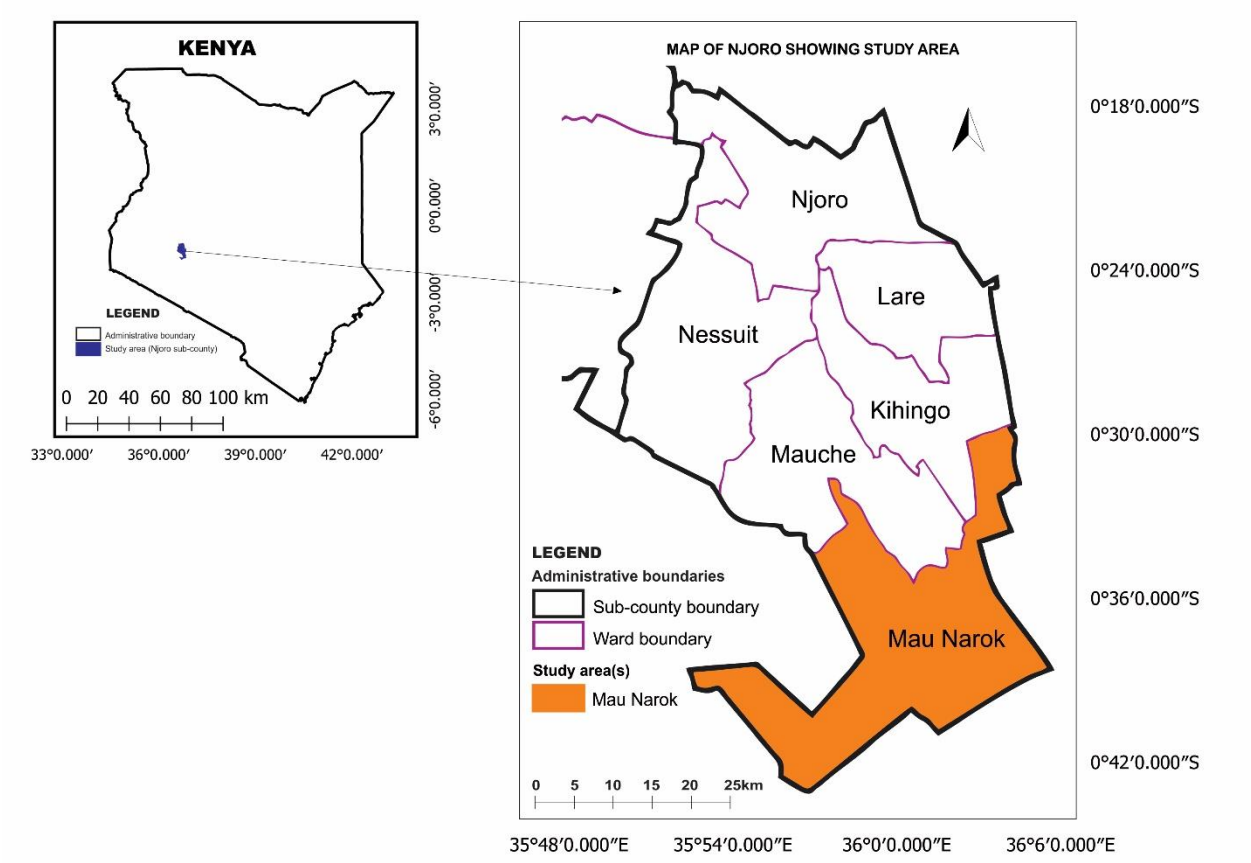

Figure 3.1: Map showing Njoro sub-county in Kenya

Source: IEBC (2022)

3.2 Research design

The research design for this study was a cross-sectional descriptive survey. In order to explain and report on the effects of non-farm employment on decision-making among smallholder farmers in Mau-Narok, Njoro Sub-County, the study's descriptive survey approach

was appropriate. This methodology was suitable since it involves gathering data from a representative sample of respondents chosen in the study area and it gives the researcher the opportunity to concentrate on particular descriptions or traits. It is also appropriate in situations where respondents' views and opinions on a certain occurrence are being sought after. Data from quantitative sources was used in the study to test and describe the relationship between NFE and value addition decisions. Quantitative data was obtained using a semi-structured questionnaire (see Appendix 1) that was personally administered to the study respondents.

3.3 Determination of sample size

The sample unit for this study was smallholder farmers in Mau-Narok ward who practiced value addition (primary, secondary and tertiary processing) in potatoes, carrots and green pea production basing on the results that were found during reconnaissance. The determination of the sample size followed the proportionate sampling methodology specified by (Cochran 1963) as follows:

$$n = \frac{z^2 pq}{e^2} \quad \ldots\ldots (1)$$

where: n = sample size, p= implied maximum possible variance q = 1-p, z = the standard value at a given confidence level ($\boldsymbol{\alpha}$ = 0.05), e = the acceptable error (precision). The study desired a 95% confidence level and 5% precision level with a z score of 1.96. In addition, the study assumed that p=0.8 since over 80% of the population within the study area engage in non-farm activities (Symbiocity, 2018). Thus, q was considered as 0.2.

The sample was determined as:

$$n = \frac{(1.96)^2\,(0.8)(0.2)}{(0.05)^2} = 245 \quad \ldots\ldots (2)$$

The derived sample size for this study were 245 respondents.

3.4 Sampling procedure

The households were selected in a cross-sectional survey through multistage sampling. In the first stage, Njoro sub-county was purposively selected due to different non-farm activities in the area, which accounts for 80% of the rural households. The second stage involved purposive sampling of Mau-Narok ward since it has the highest number of farmers in Njoro sub-county. In

the third stage, four locations in the ward were selected Likia, Mau Narok, Mwisho Wa Lami and Sururu. Lastly, systematic sampling was used in each location in the ward following the Kth sampling interval on the list provided by the sub-county agricultural officer. $K = \frac{N}{N}$ K - Sampling interval. N -total number of farmers in the cluster n -sample size in each cluster. to come up with 245 respondents as shown in Table 3.1.

Table 3.1: Sample size determination per location

Locations in Mau Narok	**Population**	**Proportion (100%)**	**Sample size**
Likia	6,517	12.4	31
Mau Narok	19,248	36.5	89
Mwisho Wa Lami	14,069	26.7	65
Sururu	12,862	24.4	60
Total	52,696	100	245

3.5 Data collection

After getting the research permit from NACOSTI, the researcher first carried out the pilot study on 50 respondents equivalent to 20% of the total sample size of the study area thereby providing a sufficient basis for carrying out a reliability test. According to Connelly, 2008 10% 0f the sample is sufficient to test for the reliability of the instruments. This pilot survey took place in Nessuit ward in Njoro Subcounty which share comparable agricultural and ecological conditions with Mau-narok ward where the study was conducted. The results of alpha 0,839 that was found indicated that the method used for data collection was valid and realiable and the study was easily replicable.

In order to fully address the research issues, data from both primary and secondary sources was gathered. A semi-structured questionnaire (see Appendix I) was used to collect primary data from the households engaging in nonfarm employment and value addition activities. The literature already in existence, including books, online sources, journals, and papers, was where secondary data was gathered.

3.6 Data analysis

Quantitative data analysis strategies were incorporated in this study. The target population was smallholder farmers engaging in non-farm employment in Mau-Narok ward, Njoro sub-county in Nakuru County. The respondents for this study were 245 smallholder farmers producing potatoes, carrots and green peas, engaging in non-farm employment and value-addition activities in Mau-Narok ward, Njoro Sub- County in Nakuru county whose data was obtained using a semi-structured questionnaire (see appendix I).

There was a combination of descriptive and inferential statistics applied. By using mean, median mode, percentages and frequency tables, descriptive statistics aided in summarizing the study's findings. Regression analysis was conducted to clarify the research questions and to ascertain how the dependent variable would respond to changes in the independent variables. By creating frequency distributions and percentage scores that were presented, discussed, and interpreted in accordance with the purpose, the Statistical Package for Social Sciences (SPSS) computer program was used to evaluate the data. In order to provide an in-depth explanation that cannot be adequately expressed statistically by SPSS, specific objectives two and three employed qualitative analysis utilizing STATA.

3.7 Analytical framework

3.7.1 The nature of value addition activities pursued by households that earn income from non-farm sources Njoro sub-county, Nakuru county

Table 3.2: Description of variables and their measurements

Variables	Description	Measurement	Expected sign
Nature of value addition activities	Primary processing	Dummy 1= if yes 0= otherwise	
	Secondary processing	Dummy 1= if yes, 0= otherwise	
	Tertiary processing	Dummy 1= if yes, 0=otherwise	

As shown in Table 3.2, value-addition activities were categorized as primary, secondary and tertiary processing. Categorization depended on the level of complexity involved in a given value addition activity and whether or not there is a change in form of agricultural products handled. These characteristics gave an image of the nature and characteristics of value-addition activities pursued by those who engaged in non-farm employment. Descriptive statistics was used to analyze this objective. This was captured through the qualitative variables below that are important in understanding the nature of value-addition activities pursued by smallholders who participate in non-farm activities. Mean, frequencies, percentages, t-test, chi-square and standard deviation of various variables were obtained to describe this objective.

3.7.2 Drivers for investment of non-farm income in value addition activities

This study assumed income earned by smallholders in non-farm employment only comes from the following trades and sales (agrovet, grocery stores, dealing sisal ropes/ firewood, livestock trading, timber selling), artisan (basket weaving for carrying agricultural goods), service (harrowing, harvesting, spraying, transport of agricultural goods), extractive (wood cutting/ lumbering) and agro-processing (posho mill). The NFEs above were chosen due to their prominence within Nakuru county (Symbiocity, 2018). The decision to invest income from nonfarm sources in value addition activities was assumed to be influenced by profit maximization, need to access more markets, minimizing post-harvest losses, achieve high product prices, access to finance, production level, type of enterprise and improve product shelf life. The value addition decisions that smallholder farmers can make were assumed to be three. They included primary processing (drying, sorting, cleaning and storage), secondary processing (milling, grinding, hulling, extracting) and tertiary processing (distribution, cooking, packaging, branding and grading).

In relation to this objective, econometric models such as conditional and nested logit, multinomial logit or Probit and multivariate logit or Probit have long been used to analyze choice-dependent categorical variables (Tarekegn *et al.,* 2017). Multinomial models are only suitable when individuals can choose one outcome from a set of mutually exclusive alternatives. However, in this study, factors that motivate investment of income from non-farm sources in value addition activities (VAA) were not mutually exclusive and there was a possibility of simultaneous correlations among these factors, therefore basing on the mutual non-exclusivity, multivariate Probit model was adopted for this study since it estimated several correlated

outcomes jointly. This is attributed to the fact that it can simultaneously capture the impact of several explanatory variables on value-addition decisions thus allowing potential correlations between unobserved factors (Greene, 2012).

The decision of whether or not to invest income from nonfarm sources in VAA was assumed to be on the principle of profit or utility maximization (Arinloye *et al*., 2015). Given a smallholder farmer *i* in making a decision of investing income in non-farm sources in a non-mutually exclusive choice of Z^{th} value addition activities, the set of choices may vary due to the differences in the decision makers (smallholders). Consider the i^{th} smallholder (*i*=1……. N) facing a decision problem on whether or not to invest income from non-farm sources in value addition activities. Let Uz represent the benefits that smallholder farmers enjoy by choosing to invest income from non-farm sources in Z^{th} value addition activity where Z represents all forms of agro value addition activities that smallholders can invest in like primary processing (Z1), secondary processing (Z2) and tertiary processing (Z3). A smallholder farmer chooses to invest income from non-farm sources in VAA if

$$Y^*iz = U^*z - U > 0. \quad (2)$$

Thus, the net benefit (Y*iz) that smallholder farmer derives from choosing to invest income from non-farm sources in VAA is a latent variable determined by observed explanatory variables (Xi) and the error term (ε_i).

$$Y^*_{iz} = X'_i \beta z + \varepsilon_i \quad (Z=1,2,3) \quad (3)$$

Hence, the econometric methodology for this study is by utilizing the unseen disturbances in Equation (3) as follows

$$YiZ = \begin{cases} 1 \; if \; YiZ > 0 \\ 0 \; Otherwise \end{cases} \quad (Z=1,2,3) \quad (4)$$

With the possibility of several value addition investment decisions in a multivariate model, the error term follows a multivariate normal distribution with a mean of zero and variance normalized to cohesion given by the matrix.

$$\Omega = \begin{pmatrix} 1 & P_{12} & P_{13} \\ P_{21} & 1 & P_{23} \\ P_{31} & P_{32} & 1 \end{pmatrix}$$

The off-inclining components in the covariance grid address the unseen connection among stochastic parts of various upper-hand choices (Tarekegn *et al*., 2017). This presumption

implies that the above condition produces a multivariate probit model together addressing a choice to acquire an upper hand. This detail with non-zero off-inclining components considers the relationship among the error terms of various unseen elements.

The implicit functional form of factors that motivate investment of incomes from NFS in VAA method will be estimated as;

$$Yiz = \beta_0 + \beta_1 Profmax + \beta_2 MinPHL + \beta_3 HighPP + \beta_4 Impshlif + \beta_5 Accmkts + \beta_6 \text{ToE} + \beta_7 \text{Prodl} + \beta_8 \text{Finance} + \varepsilon i$$

where: Y_{iz} (Z=1…3): Value addition decisions

β_0 = Constant, $\beta_1 - \beta_8$ = Coefficients and ε_i = Error term

Table 3.3: Description and expected sign of the variables to be used in the multivariate probit model

Variables	**Descriptions**	**Measurement**	**Expected sign**
Dependent			
Value addition decisions (Y=1...3)	Primary processing	1=yes, 0=otherwise	
	Secondary processing	1=yes, 0=otherwise	
	Tertiary processing	1=yes, 0=otherwise	
Independent			
Profmax	Profit maximization	Profit per Kg	+
MinPHL	Minimize post-harvest losses	Percentage of harvest lost	+
HighPP	High product prices	Price per Kg	+
Impshlif	Improved shelf life	Time months under preservation/to spoilage	+
Accmkts	Access to more markets	Distance to the market in Km	+
ToE	Type of enterprise	Value chain engaged in	+/-
Prodl	Production level	Yield per acre	+/-

Finance	Access to credit	1=Yes, 0=No	+/-

3.7.3 Effect of investment of non-farm income on value addition decisions among smallholder farmers in Njoro sub- county, Nakuru county

In this study it was assumed that income from NFE (independent variable) influences VAA (dependent variable) made by smallholder farmers. In order to determine the effect of income from non-farm sources on Value addition decisions made by smallholder farmers, two econometric methods can be used propensity score matching model and endogenous switching regression model. Both models are suitable when dealing with two regimes for example adopters and non-adopters. However, the decision to invest income from NFS in VAA maybe influenced by the perceived benefits associated with a given value addition activity according to a given smallholder farmer. Perception being an unobservable characteristic as a result of self-selection gives rise to endogeneity in the model (Difalco & Veronesi, 2013). The actual effect of income from NFS on VAA cannot be predicted with certainty if endogeneity problem is not dealt with.

A Multinomial endogenous switching regression model was used to determine the effect of non-farm sources on VAA among SHF in the study area. The model was appropriate because it corrects for both observed and unobserved biases that may result from VAA made basing on perceived benefits. The model allowed for more than two options and evaluates both individual and combined value addition activities and captures the interaction between and among them while correcting the outcome equations irrespective of whether the assumption of the independence irrelevant alternative is achieved or not (Bourguignon *et al.,* 2007). Basing on the fact that a smallholder farmer can participate in a combination VAA and that the decisions to participate in VAA can be influenced by unobserved characteristics, a MESR model was used to analyze this objective.

The MESR model was conducted in two stages that is multinomial logit selection model and endogenous switching regression model. In the first stage, the decision to invest in a single or a combination of VAA was modeled using multinomial logit selection model. In the second stage the effect of NFI on VAA was modelled using MESR. The model used the Average Treatment on the Treated (ATT) to estimate the effect of NFI on the outcome variable.

Multinomial logit selection model

It was assumed that a SHF invests NFI in a single or a combination of VAA that provides them with maximum utility. SHF aim to maximize their utility, U_{im} by comparing the utility provided by other VAA, U_{ik} such that a SHF *i* will choose a single or a combination ≠over any alternative *k* if $Uim_{>} U_{ik}$, $k \neq m$. Basing on Bourguignon *et al.* (2007), let U*im represent the indirect utility associated with the m^{th} VAA, m=1…3, for SHF *i* such that

$$U^*_{im} = X_i B_m + \boldsymbol{\varepsilon}_{im} \quad (5)$$

where X_i represents exogenous covariates such as profit maximization, level of production, type of enterprise and socioeconomic characteristics and ε_{im} idiosyncratic unobserved stochastic component. Although the utility of investing in a given VAA is not observed, VAA can be observed such that a SHF *i* will choose a VAA *m* over other value addition activities *k* if

$$U = \begin{cases} 1 \text{ if } U^*im > \max k\neq 1\ (U^*ik) \text{ or } \omega_{i1} < 0 \\ \qquad\qquad \text{for all } k\neq m \\ M \text{ if } U^*im > \max k\neq 1\ (U^*ik) \text{ or } \omega_{im} < 0 \end{cases} \quad (6)$$

where $\omega_{i1} = \max k \neq m\ (U^*ik - U^*im) < 0$. Equation (6) shows that SHF *i* chooses a VAA m to maximize expected benefits if it provides greater expected utility than the alternative choice k, k ≠ m if max k≠1 (U*ik – U*im) < 0. Under the assumption that ε_{im} are independent and identically distributed, the probability that SHF *i* chose VAA m was expressed using a multinomial logit model (McFadden 1973).

$$P_{im} = P_i\ (\omega_{im} < 0 \mid X_i) = \frac{\exp(\beta m X i)}{\sum j\ k\neq 1 \exp(\beta k X i)} \quad (7)$$

Multinomial endogenous switching regression

In the second stage a MESR was used to determine the effects of NFI on VAA. This was achieved using the Average Treatment on Treated (ATT). The model thus implied that a SHF i faces j regimes and one regime per value addition decisions (VAD), therefore, the reference category in this case was m = 0 representing non-investment in VAD. The other category considered participating in at least one value addition and their respective combinations by SHF represented by *m*= 1,2,3. Therefore, the likely outcome equation for each possible regime m was given as

$$\begin{cases} \text{Regime 1: } Y_i 1 + \beta_i Q_i 1 + Z_i 1 \text{ if } U = 1 & (8a) \\ \text{Regime M: } Y_{im} = \beta_m Q_{im} + Zi_m \text{ if } U = M & (8b) \end{cases}$$

where Y_i referred to the value addition activity that a SHF *i* participates in regime *m* (1,2,3*)* and Q represents a set of exogenous variables while β represents the error term to capture the

uncertainty faced by a SHF. There could be unobserved correlated factors between the first and the second stage regression model since β and Z are not independent. Therefore, to avoid biasness, the inclusion of a selection correction factor is required (Bourguignon *et al.*, 2007) in equation (8). The model was used to correct the correlation between the error terms from the multinomial logit model estimated in the first stage and the error terms from each of the regimes in equation (8). The selectivity term (λ) was incorporated in equation (9) to account for selection bias such that:

$$\begin{cases} \text{Regime 1: } Y_{i1} = \beta_1 Q_{i1} + \sigma_1 c_{i1} + v_{i1} & \text{if } U = 1 \quad (9a) \\ \text{Regime M: } Y_{im} = \beta_m Q_{im} + \sigma_m \lambda_{im} + v_{im} & \text{if } U = M \quad (9b) \end{cases}$$

where λ is predicted and computed from the probability estimates in equation (7), v is the error term with the expected value of 0 and σ is the covariance between β and z.

The predictions and estimations from equation (9) above allowed the calculation of actual and counterfactual effects that were used in computing the exact effects of NFI on VAD. This approach corrected the selection bias due to unobserved heterogeneity while at the same time controlling the selection bias due to observed heterogeneity (Kassie, 2015). ATT in the actual and counterfactual can be computed from equation (8) as follows

Smallholders who invest in value addition activities (actual)

$$E(Y_{i2}/1 = 2) = \beta_2 Q_i + \sigma_2 \lambda_2 \quad (10a)$$

$$E(Y_{im} / I = M) = \beta_m Q_i + \sigma_m \lambda_m \quad (10b)$$

Deriving the expected of VAA by smallholder farmers who participate in value addition activities m in the counterfactual hypothetical case that they participated in different value addition activities from the one they participated in can be done using equation (8).

Smallholder farmers, if they decide to participate in other value addition activities than the ones they participated in (counterfactual)

$$E(Y_{i1} / I = 2) = \beta_1 Q_i + \sigma_1 \lambda_m \quad (11a)$$

$$E(Y_{im} / I = M) = \beta_1 Q_i + \sigma_1 \lambda_m \quad (11b)$$

equation (10a, 10b) represents the actual expected value addition activities participated in that is actually observed for smallholder farmers who participate and those who may not while equation (11a, 11b) their respective counterfactual expected value addition activities.

To derive the unbiased estimated of the ATT, the expected value can be used. This will the allow calculation of ATT as the difference between 10a and 11a or 10b and 11b

$$ATT = E(Y_{i2}/I=2) - E(Y_{i1}/I=2) = \beta_2 Q_i + \sigma_2\lambda_2 - \beta_1 Q_i + \sigma_1\lambda_2 = Q_i(\beta_2 - \beta_1) + \lambda_2(\sigma_2 - \sigma_1) \quad (12)$$

Equation (12) is divided into two separate terms on the right-hand side (first and second terms). The first represents expected change in value addition decisions made by smallholder farmers while the second (l) represents the fact that the effect of the unobserved terms are cancelled out.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

The findings of the study on how non-farm employment affects smallholder farmers' decisions to add value in Mau-Narok ward, Njoro sub-county, Nakuru county are presented in this chapter. The factors that motivate households to spend non-farm income on value-adding activities and the effects of non-farm income investment on value-adding decisions are among the analyzed and discussed aspects, which also include the nature of value-adding activities carried out by smallholder farmers who engage in non-farm activities.

4.2 Descriptive results

4.2.1 Socio-economic characteristics of smallholder farmers who engage in non-farm employment and value addition activities

A summary of rural household and institutional characteristics is presented in Tables 4.1. The household characteristics analyzed include gender, age, marital status of household head, non-farm activities, enterprises that the farmers engage in, time in hours that the farmers spend in non-farm activities, income from non-farm activities, family size, size of farm in acres, need to attract high market price Access to credit, need to improve Shelf life, need to minimize post-harvest loss, market participation.

According to the results in Table 4.1, the average age of the household head was 43.69 years and it was statistically significant at 1% ($p = 0.000$). It is probable that older people's propensity for extensive networking and wealth of experience accounts for the majority of their engagement in value-added activities. Age being a moderating variable was looked into as it has been noted to drive farmers' decisions and participation in adoption of technologies, in this case value addition being the technology of choice. Therefore, the study found that value addition activities were influenced by the age of the smallholder farmers as it requires energetic individuals to thrive given the logistics involved. This is consistent with findings from Afande *et al*. (2015) who revealed that the years of experience in farming makes them more qualified.

Among these farmers, the average household size was approximately 5 members. At 10% ($p=0.087$), household size had a substantial impact on value-added activities. These findings

implied that large families were more likely to add value. Household size as a variable is core as it's a proxy for labour availability to facilitate agricultural practice. The optimistic prediction of family size on the adoption of value addition was anticipated because the hypothesize was that large family sizes are typically supply labour. After all, value addition as a technology is labour-intensive. Odoemelam *et al*. (2014) reiterated that greater household sizes aid in labor provision by supplying the manpower required to add value.

Another measure considered was the amount of time value adders spent on non-farm activities. The mean duration of non-farm activities for actors was 6.83 hours which was significant at 1% (p = 0.005). Farmers in the study area ensured that they allocated a number of hours after engaging in their normal day to day farm activities, that is of course after taking a small break to freshen up, re-energize and later engage in the non-farm activity of their preference. This ensured that their income flow was stable further encouraging them to participate in the particular value addition activity that they saw fit. A household allocates its total time endowment, among farm work, nonfarm activities, market work, and not to mention leisure (Chepkoech, 2014).

Value adders made an average of around KES 23,566 nonfarm income each month. At 5% (p = 0.010), the income disparity between these groups was statistically significant. Higher paid actors can afford to cover a portion of the costs associated with the requirements at different nodes in the chains. More income translated into improved and increased value addition capabilities of the respondents, boosting their performance as a result of improved purchasing powers. Higher off-farm incomes enhance agriculture commercialization by smallholder farmers if used as a source of liquidity for farm investments (Musyoka *et al*.,2020; Woldeyohanes *et al*., 2017).

The average number of enterprises owned by farmers was 2.24 and was statistically significant at 1% (p =*0.000*). Having numerous enterprises allows farmers to diversify, giving them access to a larger market and lowering the risks brought on by price swings. The respondents in Mau- Narok engaged in the production of various crops such as potatoes, cabbages, carrots green peas, maize, beans and barley just to mention a few with which they managed to harvest a substantial share, consumed some and value added the rest before finally taking them to the market. This allowed them to earn extra income than they would have while selling raw products.

Findings in Table 4.1 below showed that the need to reduce post-harvest losses concerned 38.37% of value chain participants and was only significant 10% (p=0.071) level. Minimizing losses at different stages of the value chain is likely for value chain actors whose primary concern is lowering post-harvest losses. The study's findings affirmed that the respondents' interest in reducing post-harvest losses increased their ability to capture premium prices in turn elevating their profit margins as a result of the value addition activities they ventured in. This is in agreement with (Agric Technical working group, 2022).

Acquiring new agricultural technologies requires credit. Out of all the value chain actors, 16.33% could obtain credit though at a 10% (p=0.093) significance level according to the results in Table 4.1. Orinda *et al*. (2017) were in agreement with these findings. While credit is required to purchase some of the technologies and equipment utilized in the value chain's diverse activities, the proportion of players who were able to obtain credit was much lower. The findings elucidated that the smallholder farmers in the study area lacked access to formal lending institutions as they were perceived as bad risk by the said institutions. The inaccessibility of capital led to the staggering increase of value addition activities as it was evident that most of them engaged in primary processing as it does not require much capital to facilitate the processes required.

Table 4.1: Household demographics by value chain categories

Variables	Overall (N=245)	Primary (n=184)	Secondary (n=99)	Tertiary (n=166)	p-value/ Chi2
Avg. age of HH head	43.69±12.32	44.06±12.22	43.87±11.50	44.74±13.28	0.000***
Gender of household head (%)					
Male	56.33	58.70	51.52	57.83	0.291
Female	43.67	41.30	48.48	42.17	
Marital Status of household head					
Single	18.78	16.30	18.18	19.88	0.324
Married	81.22	83.70	81.82	80.12	
Household size	4.94±1.99	4.81±1.83	5.65±2.14	5.03±2.08	0.087*
Farm size	1.75±1.59	1.76±1.54	1.65±1.45	1.66±1.33	0.778
Time (Hours) NFA	6.83±1.80	6.65±1.74	7.36±1.85	6.78±1.81	0.005***
Income	23566±22403	21453±18726	25424±22620	23913±23379	0.010**
Enterprise	2.24±0.91	2.42±0.85	2.13±0.94	2.34±0.93	0.000***
Market access	34.69	38.04	31.31	34.34	0.487
Minimize post-harvest loss	38.37	38.59	32.32	37.95	0.071*
Improved Shelf life	48.57	50.00	50.51	47.59	0.379
Attract high market price	78.37	78.26	79.80	77.11	0.302
Access to credit	16.33	18.48	9.09	13.86	0.093*

Note: ***, **, * significant at the 1%, 5%, and 10% level, respectively, Mean ± Standard Error (S. E).

Table 4.2: Results on age, farm size, time and income from non-farm employment

Variable	Male	Female	Mean	Std. dev	t-test
Age	44.3	42.7	43.7	12.329	1.010
Farm size	2.0	1.4	1.8	1.590	3.091***
Time	6.9	6.7	6.8	1.803	0.966
Income	24809.28	21962.62	23566.04	22403.93	0.986

Note: *** Significant at 1% level.

Table 4.2 shows that the mean age of the total sample households was found to be 43.7 years with standard deviation of 12.329 years. The t-test revealed that the mean age between men and women was not statistically significant.

The mean land holding size in acres of the sample households in the study area is depicted in Table 4.2. The overall mean land holding size for sample households was found to be 1.8 acres per household with a standard deviation of 1.590 acres. The statistical analysis showed that there was a statistical significance of 1% similarity between men and women respondents with respect to participation in non-farm employment and value addition with regards to the size of land owned.

The overall mean time for participation in non-farm activities is 6.8 hours for sample respondents with a standard deviation of 1.083 hours. However, the statistical analysis showed that there was no significant disparity between men and women and the time took in participating in non-farm employment. This finding is in agreement with those of (Chepkoech, 2014).

The mean income of the total sample households was found to be KES 23566.04. The result shows that women and men earn similar income from non-farm activities. On average, women and men earn monthly incomes of KES 21962.62 and KES 24809.28, respectively from non-farm activities. The t-test revealed that the mean income of households was not statistically significant. Johnson *et al.* (2015) findings eluded that access and control of wealth was necessary for alleviation of poverty levels. They continued to say that the access and control of wealth on the part of females through projects related to agricultural development, was hindered by household duties and societal norms.

4.3 Nature of value addition activities pursued by smallholder farmers who engage in non-farm activities

Results in Table 4.3 show the different categories of non-farm activities and value addition techniques practiced by smallholder farmers in Mau-Narok ward in different enterprises (crops grown in the area).

4.3.1 Non-farm activities and value addition activities

In order to identify the characteristics of non-farm activities in the research region, it essential to analyze the different non-farm activities. Although agriculture still accounts for the majority of the economy in rural Sub-Saharan Africa (SSA), a sizable and rising proportion of households diversify their sources of income by working outside the farm Yeboah and Jayne, (2018), and non-farm businesses (NFEs) in particular (Nagler &Naudé, 2017).

As indicated in Table 4.3, rural farm households in the study area practiced different non-farm activities. More specifically, of the participants (55.51%) engaged in trade and sales, (26.94%) in services, (17.4%) agro-processing, (6.53%) in both trade and services, (2.5%) in artisan and (1.2%) in extractives to supplement their farm income. This study's findings affirmed that the respondents took time after tedious hours in their farms to look for more ways to put more money in their pockets as engaging in farming alone proved to be insufficient. Most of them preferred to trade as it was considered one of the easiest to enter as it did not require a lot of capital not to mention experience. This is supported by Seid (2017) who concluded that many households engage in activities that are easy to do, such as trade and sales, as opposed to activities that require higher upfront costs, such as transport (services), or investment in education, e.g. Professional Services.

Different types of non-farm activities can be performed by farmers in rural areas. These activities and their dominance vary from place to place. In the study site, the predominant non-farm activities are trading and handicraft (services). The smallholder farmers in Mau-Narok region engaged in these activities for a number of reasons not limited to land fragmentation, increased family sizes, climate variability, some had skills tailored to suit specific activities hence opted to make use of them and utilize the time left after farming. To top it off, some of the farmers sought to maximize the profits earned from farming by investing them in non-farm activities

hence sustaining their monthly incomes, others mostly ventured in the activities as a result of increased opportunities.

4.3.2 Enterprises (Crops grown by the respondents)

The respondents grew different types of crops, which included barley, potatoes, cabbages, beans, maize, garden peas and carrots. The frequency and percentages of the respondents growing the crop is given in Table 4.3.

Table 4.3: Results on non-farm activities and enterprises pursued by smallholder farmers in Mau-Narok ward

Variable	Characteristic	Frequency (Percentage)				Chi2/ Pr
		Overall	**Primary**	**Secondary**	**Tertiary**	
Non-farm activities	Trade and sales	136(55.5)	103(56.0)	54(54.6)	94(56.6)	0.235
	Artisan	6(2.5)	5(2.7)	2(2.0)	4(2.4)	
	Agro-processing	18(17.4)	12(6.5)	9(9.1)	12(7.2)	
	Extractive	3(1.2)	1(0.5)	2(2.0)	3(1.8)	
	Service	66(26.9)	50(27.2)	22(22.2)	41(24.7)	
	Trade and sales /service	16(6.5)	13(7.1)	10(10.1)	12(7.2)	
Enterprises						
	Potatoes	167(68.2)	151(82.1)	50(50.5)	116(69.9)	0.000***
	Carrots	64(26.1)	56(30.4)	11(11.1)	43(25.9)	0.000***
	Green peas	124(50.6)	108(58.7)	30(30.3)	89(53.6)	0.003***
	Others	107(43.7)	61(33.2)	91(91.9)	72(43.4)	0.891

Note: *** significant at the 1%, () denotes percentage

Main crops grown by the respondents included potato, carrots, garden peas and others (maize, beans, barley, cabbages). Majority of the respondents grew potatoes (50.6%), green peas (21.2%), others (14.7%) and finally carrots (13.5%). Crop diversification improves household food security since different crops are affected differently by the same climatic conditions. In addition, it is a strategy for enhancing the welfare of low-income rural households, mitigation of risk, employment generation and conservation of biodiversity (FAO, 2017). The possibility of

interruption in insect and diseases cycles and utilization of resources make the diversified system more preferable compared to the monocrop production system as suggested by the inference.

There was significant relationship between those farmers who engaged in the production of potatoes, carrots and green peas, participated in and value addition activities at 1% (p =*0.000*), (p =*0.000*) and (p = *0.003*) respectively.

4.3.3 Value addition activities that smallholder farmers in Mau-Narok ward took part in while engaging in different enterprise

Results in Table 4.4 show the value addition techniques practiced by smallholder farmers in Mau-Narok ward in different enterprises. The techniques included sorting, drying, cleaning, storage, frying, extracting, milling, packaging, and distribution.

Most of the farmers carried out value addition in form of sorting and storage. As indicated in Table 4.4, the most common form of value addition practiced by the farmers is sorting (83.1%) under primary processing. Technically, this suggests that the purchasers in the area have a preference of receiving sorted raw Irish potatoes, and the processors also demand sorted and graded Irish potatoes according to size and variety, and normally the price goes up after value addition. Additionally, the Irish potato farmers must sort the small potatoes that will be used as potato seed and the spoilt potatoes that were harvested that will be utilized for home consumption There was significant relationship between those farmers who engaged in the production of potatoes and sorting activities at 1% (p =*0.000*).

This study has demonstrated that (68.2%) of the respondents stored their potatoes after sorting them. Majority of the respondents preferred to mostly sort and store their produce as it requires little to no training. Also, the amount of capital needed to facilitate these processes is not much hence the decision to venture into them. In as much as they stored some of their produce, the farmers complained of lack of sufficient storage facilities for their surplus produce. Much as the farmers would want to store more of their produce for lean seasons, this still serves as a top limitation. Potato producers choose to add value to their products in order to boost their income because the high cost of production limits their ability to make profits. There was significant relationship between those farmers who engaged in the production of potatoes and storage activities at 1% (p =*0.000*).

Results from Table 4.4 show that (37.4%) and (33.3%) of the farmers in Mau -Narok ward engaged in frying as part of secondary processing in potato value addition. Frying was considered expensive, that is why most farmers did not invest in them. Secondary level of value addition was not significant due to its expensive nature.

Enterprise	**Level of value addition**	**Nature**	**Frequency (Percentage)**	**Chi2**
Potato	Primary	Sorting	153(83.1)	0.000***
		Storage	167(68.2)	0.000***
	Secondary	Frying	33(33.3)	0.174
	Tertiary	Packaging	94(56.6)	0.000***
		Distribution	23(13.9)	0.000***
Carrot	Primary	Cleaning	20(10.9)	0.254
		Sorting	56(30.4)	0.001***
	Secondary	Extraction	8(8.1)	0.000***
	Tertiary	Packaging	36(21.7)	0.000***
		Distribution	10(6.0)	0.000***
Green peas	Primary	Drying	41(22.3)	0.015**
		Sorting	19(10.3)	0.382
		Storage	68(37.0)	0.000***
	Tertiary	Packaging	71(42.8)	0.000***
		Distribution	20(12.1)	0.000***
Other(s)	Primary	Drying	58(31.5)	0.000***
		Sorting	3(1.6)	0.045**
		Storage	56(30.4)	0.000***
	Secondary	Milling	5(5.1)	0.257
	Tertiary	Packaging	68(41.0)	0.000***

	Distribution	3(1.8)	0.000***

Table 4.4: Value addition activities pursued by smallholder farmers in Mau-Narok ward

Note: ***, **, * significant at the 1%, 5%, and 10% level, respectively, () denotes percentage

Majority of the Irish Potato farmers (56.6%) undertook value addition in packaging and (13.9%) in distribution under tertiary processing as shown in Table 4.4. The results indicate that the respondents took it upon themselves to package their potatoes in the 90kgs and 150kgs sacks for their customers. After this, the clients came to pick them while for other, they distributed the packaged potatoes to the various locations as per their agreement with the customers. There was significant relationship between those farmers who engaged in the production of potatoes and tertiary value addition activities (packaging and distribution) at 1% (p *=0.000*).

A considerable number of the farmers were involved in sorting as a value addition technique in carrots. (30.4%) sorted their carrots as compared to (10.9%), who cleaned theirs. Sorting was done to differentiate the carrots according to size and quality. Those cleaning the carrots complained of difficulty in accessing the water used to clean the carrots. others opted to harvest and sell them immediately after thus earning less compared to those who cleaned. Contrary, Arah *et al.* (2016) revealed that most farmers in developing countries hardly use this technique. This realization is due to the scarcity of water at the production sites, which offers less incentive to create value due to its high costs. There was significant relationship between those farmers who engaged in the production of carrots and sorting activities at 1% (p *=0.001*). On the other hand, there was no significant relationship between those farmers who participated in carrot production and cleaning activities at $p<0.05$.

Under secondary activities (8.1%) of the farmers engaged in extraction. The number of smallholder farmers who took part in secondary processing of carrots was reportedly low as the consumer response rate was quite low. The preparation of carrot and beetroot juice in Mau-Narok by the carrot producers was not welcomed with open arms by some of the residents in the area. This was due to lack and or awareness of the consumers in the region. It was also partly because there was limited product diversification by carrot producers. There was significant relationship between those farmers who engaged in the production of carrots and extraction activities at 1% (p *=0.001*). These findings are in agreement with those of (Janve *et al.,* 2014; Raees-ul & Prasad, 2015). (21.7%) and (6.0%) of the carrot farmers packaged and transported

their produce respectively. There was significant relationship between those farmers who engaged in the production of carrots and tertiary value addition activities (packaging and distribution) at 1% (p =*0.000*). The findings are in line with those (Issa *et al.*,2022).

Under green peas production, (22.3%) were involved in drying, (10.3%) in sorting and (37.0%) were involved in storage. There was not much activity under green peas production when it came to adding value as the farmers only sort and graded the peas according to the quality. Furthermore, they dried them for preservation for later use and most importantly for planting in the subsequent season. There was significant relationship between those farmers who engaged in the production of green peas and drying activities at 5% (p =*0.015*). However, there was no significant relationship between those farmers who participated in green peas production and sorting activities at $p<0.05$.

Majority of the green peas farmers (42.8%), undertook value addition in packaging and (12.1%) in distribution under tertiary processing as shown in Table 4.4. The green peas were packaged in sizeable bags and distributed according to the understanding of the two parties. There was significant relationship between those farmers who engaged in the production of potatoes and tertiary value addition activities (packaging and distribution) at 1% (p =*0.000*).

On the other hand, in other crops (maize, beans, barley and cabbages) production under primary processing, (31.5%) were involved in drying, that is for maize, beans and barley. (1.6%) in sorting, this was for all of them and lastly (30.4%) in storage for maize, beans and barley. The value addition activities under these crops were not much as the farmers in the study area are challenged by short comings that are not limited to inadequate storage facilities, brokers who manipulate prices, and costly value addition assets. There was significant relationship between those farmers who engaged in the production of maize, beans, barley and cabbage and drying activities at 1% (p =*0.000*). A significant relationship between the production of (maize, beans, barley and cabbage) and sorting activities at 5% (p =*0.045*) was also realized. On top of that, a similar realization on the significant relationship between the production of (maize, beans, barley and cabbage) and sorting activities at 1% (p =*0.000*)

Milling was done by (5.1%) of the farmers under maize production as a value addition activity under secondary processing. This was mainly carried out by farmers who mostly owned posho mills as their income diversification mechanism. Most of the farmers preferred to either sell fresh maize, whereas others sought to dry them first before selling them. A number of

farmers owned posho mills while other posho mills were owned by residents who were not farmers necessarily. Enzama (2016) and Fiedler *et al.* (2014) also found similar results. There was no significant relationship between those farmers who participated the production of (maize, barley) and milling activities at $p<0.05$.

Packaging and distribution were also among the techniques being practiced by the farmers engaged in the production of the other crops in Mau-Narok, that is (maize, beans, barley, and cabbages. (41.0%) did packaging and (59.0%) were involved in distribution of the other crops. As mentioned earlier packaging and distribution of produce was done as per the understanding of the two parties, that is the producer and the buyers This was supported by Opara and Mditshwa (2013) who concluded that packaging was a crucial part of the food chain since it helps ensure the safe handling and distribution of processed and fresh goods. There was significant relationship between those farmers who engaged in the production of other crops and tertiary value addition activities (packaging and distribution) at 1% ($p = 0.000$).

4.4 Preliminary diagnostics of the variables to be used in the econometric analysis

Prior to data analysis, preliminary diagnostics were conducted to check whether there was presence of heteroscedasticity and multicollinearity in the statistical variables used in the econometric analysis. To detect heteroscedasticity, Breusch Pagan Test and White test was used for all hypothesized explanatory variables. First Variance Inflation Factor for continuous variables and pairwise correlation for categorical variables were used detect multicollinearity.

4.4.1 Multicollinearity

When two or more predictor variables in the regression model have an ideal relationship, a multicollinearity problem arises (Yang & Wu, 2016). Even though the overall model may be significant, this may result in a lack of statistical significance for each individual predictor variable. Since the Mean Variance Inflation Factor (VIF) is 1.16, which is less than 10, the findings from Table 8 demonstrate that multicollinearity was not present.

Additionally, a pairwise correlation was performed for each categorical variable, and the results showed that there was no meaningful association between the categorical variables. The pairwise correlation values found between 0.0048 and 0.4424 are presented in Table 4.5 below. When a pairwise correlation value of a variable exceeds 0.8, the variable is said to be highly correlated (Gujarati, 2003).

Table 4.5: Results of multicollinearity test using VIF

Variable	VIF	1/VIF
Age	1.23	0.81442
Size	1.23	0.816173
Time	1.16	0.859842
Income	1.13	0.886769
Farm Size	1.03	0.968758
Mean VIF	1.6	

Note: VIF refers to Variance Inflation Factor

Table 4.6: Results for multicollinearity test using pairwise correlation

Variable	Gender	Marital status	Enterprise	Profit max	Market access	Post harvest losses	Production level	Shelf life	High prices	Credit access
Gender	1									
Marital status	0.0092	1								
Enterprise	0.1050	-0.0123	1							
Profit max	0.0441	-0.0156	0.0415	1						
Market access	0.0886	0.0352	-0.0737	-0.0292	1					
Post-harvest losses	0.0160	0.0228	0.0037	0.1672	0.1479	1				
Production level	-0.0187	0.0414	-0.2036	0.1171	-0.0125	0.0753	1			
Shelf life	-0.1322	0.0159	-0.0123	0.2336	0.1495	0.4424	-0.0171	1		
High prices	0.0770	-0.0174	-0.0347	0.0405	0.1747	0.3330	-0.0048	0.2131	1	
Credit access	-0.0341	0.0368	0.0237	0.2102	0.3044	0.3328	0.2766	0.2999	0.1516	1

4.4.2 Heteroskedasticity

Every time the variance of the unobserved components varies between various population segments, heteroskedasticity is present (Williams, 2020). Graphical methods or relevance tests like the Breusch-Pagan or White tests can be used to identify the presence of heteroscedasticity. The Breusch-Pagan test only looks for linear heteroskedasticity, but the White test permits non-linear and interaction effects of independent factors on the error variance. Additionally, in contrast to the Breusch-Pagan test, the White test can identify a broader variety of heteroskedasticity (Woolridge, 2016). In this study as depicted in Table 4.7, there was no presence of heteroskedasticity since a chi2 value of 151.51 was significantly small. Therefore, the variables were homoscedastic according to white test. Alternatively, Breusch Pagan test showed that there was no presence of heteroskedasticity since the Chi-square value is 29.89.

Table 4.7: Results of heteroskedasticity test using the white test

Source	Chi2	Df	P
Heteroskedasticity	151.93	127	0.0651
Skewness	51.84	15	0.0000
Kurtosis	4.66	1	0.0309

Note: chi 2 = chi-square; df = degrees of freedom and p value = significance level

4.5 Drivers for the investment of non-farm income in value addition

The result from the likelihood ratio of Wald chi-square was highly significant at the 1% level (p-value = 0.0001). The result indicated that the variable used in this study appropriately explained the model. In addition, the likelihood ratio test showed a significant effect at 1% (p-value 0.0000), indicating no correlation between the personal equation in the MVP model. Therefore, the use of the MVP model was valid in this study. Wald chi^2 (45) = 91.00; Prob > chi^2 = 0.0001; *N* = 245; Likelihood ratio test of rho21 = rho31 = rho32 = 0, chi^2 (3) = 52.7439

Household head's gender positively predicted the adoption of value addition activities but only at 10% significance level as shown in Table 4.8. All other factors held constant, if the number of male farmers increased by one unit, the likelihood of value addition would increase by 0.323 units The results suggested that male-headed smallholders had a higher propensity to intensify value addition practices than female-headed households. The findings concur with the notion that male-headed strengthen agricultural practices since they control production resources such as labour and land.

Table 4.8: Multivariate probit model results for drivers for the investment of non-farm income in value addition

Variable	Primary			Secondary			Tertiary		
	Coef.	Std. Error	p>z	Coef.	Std. Error	p>z	Coef.	Std. Error	**p>z**
Gener	-0.399	0.241	0.098	0.323*	0.186	0.082	0.069	0.175	0.694
Age	0.014	0.012	0.249	0.001	0.009	0.880	0.021**	0.009	0.018
Marital status	0.044	0.190	0.818	-0.261	0.170	0.124	-0.108	0.152	0.476
Household Size	-0.200**	0.066	0.002	0.153***	0.053	0.004	0.056	0.053	0.282
Farm size	-0.145*	0.079	0.068	-0.033	0.068	0.628	0.132**	0.060	0.027
Time	0.024	0.071	0.734	0.124**	0.054	0.022	0.050	0.053	0.349
Income	0.843**	0.000	0.053	-0.000	0.000	0.470	-0.000	0.000	0.312
Enterprise	0.759***	0.168	0.000	0.070	0.115	0.544	0.214**	0.107	0.046
Profit Maximization	-0.131	0.256	0.610	0.091	0.201	0.649	0.009	0.190	0.964

Market access	-0.552**	0.262	0.036	-0.045	0.202	0.826	0.060	0.196	0.760
Minimize post-harvest losses	0.060	0.273	0.827	0.097	0.220	0.659	-0.043	0.223	0.846
Production level	-0.652**	0.281	0.021	0.274	0.209	0.190	0.045	0.187	0.810
Improve Shelf life	-0.043	0.263	0.871	-0.053	0.214	0.805	0.101	0.208	0.628
High product prices	-0.035	0.294	0.904	0.003	0.231	0.989	0.004	0.228	0.986
Credit access	0.137	0.372	0.712	0.716**	0.295	0.015	-0.001	0.282	0.998
Constant									

Multivariate probit regression Number of observations 245

Wald Chi2 (45) = 91.00

Log pseudo likelihood -317.20833

Prob > Chi2 0.0001

Note: ***, **, * significant at the 1%, 5%, and 10% level, respectively, Std. Error is Standard error.

The results also corroborate with that of Oyetunde-Usman *et al*. (2021) who reported that male-headed households intensified sustainable agricultural practices and attributed it to poor access to complementary inputs. The positive prediction was in line with previous literature that male dominates farming resources.

According to Dimelu *et al.* (2020), age is a crucial consideration when making decisions that may affect one's livelihood. Additionally, a person's age represents their level of maturity, which determines their capacity and interest in engaging in particular activities. Age is positively and significantly correlated with probability of participation in value

addition in particular, tertiary processing at 5% significance level. The results imply that ceteris paribus, if the age of the household head increases by one unit, chances of participation in value addition activities increases by 0.021 units. These findings implied that older farmers, in particular, have more economic options and resort to tertiary value addition to earn income. It could also mean that older farmers are likely to have been exposed to extensive production technologies and environments, accrued more assets, and established wide social networks, and hence are more likely to adopt. This result is contrary to that of Donkor *et al.* (2018) who reported that older farmers were less involved in value addition in the cassava value chain in Nigeria.

Time is positively and significantly associated with the probability of value addition especially secondary processing at 5% significance level. The results imply that ceteris paribus, if time taken to undertake non-farm activities increases by one unit, chances of participation in value addition increases by 0.124 units. This is attributed to the fact that the hours utilized in non-farm activities increases the likelihood of a smallholder farmer earning more income which can eventually be diverted to value addition activities. This was informed by the fact that the farmers were willing to dedicate part on their time in engaging in activities other than farming to boost the income they get from farming activities, ultimately investing it in value-added activities. Chepkoech (2014) previously challenged this argument.

An increase in non-farm Income only significantly affect investment in primary value addition positively at 5% significance level. All other factors held constant, if non-farm income increased by one unit, the probability of engaging in value addition activities would increase by 0.843 units. This can be attributed to the fact that high income farmers are usually more risk takers than their lower income counterparts who are risk-averse. Consequently, Musyoka *et al.* (2020) found that off-farm income positively correlated with mango farm-level value addition in Kenya.

Production level is associated negatively and significantly with value addition at 5% level. The results imply that other factors held constant, if production level increases by one unit, the likelihood of participation in value addition decreases by 0.652 units. The negative sign indicates that farm households producing in large quantities are less likely to invest non-farm income on value addition activities instead they decide to maximize on economies of scale and earn additional income. This was informed by exploitation by middlemen who undermine production efforts of farmers and the development of agro-processing industries.

Access to credit had a positive coefficient and significantly affected farmers' participation in tertiary processing at 5% significance level. The results imply that other

factors held constant, if credit access increases by one unit, the likelihood of participation in value addition increases by 0.716 units This is because access to credit supports farmers' finance if they wish to engage in value addition activities or any other activity, they would wish to engage in. Given that credit places farmers in a position to meet any additional costs arising from such activities. This result corroborates with previous studies that found a significant positive correlation between value addition and access to credit among cassava farmers in Nigeria (Donkor *et al.,* 2018) and mango farmers in Kenya (Musyoka *et al.,* 2020). Based on these previous studies, we expected the use of credit to be positively correlated with participation in value addition and, as these activities require capital investment. Credit helps smallholder farmers with limited capital to overcome liquidity constraint and increase their capital, which can be invested in value addition.

Farm size coefficient positively and significantly affected value addition activities at 5%. The results indicate that ceteris paribus, if farm size increases by one unit, chances of participation in value addition increase by 0.132 units. The positive sign indicates a positive relationship between farm size and participation in tertiary processing in the study area. Farm size influences a farmer 's decision on enterprise diversification hence more enterprises can be undertaken simultaneously. On the other hand, only at 10% is primary processing significant. The results indicate that ceteris paribus, if farm size increases by one unit, chances of participation in value addition decrease by 0.145 units. The negative sign indicates an inverse relationship between farm size and participation in primary processing in the study area. If farmers owned large parcels of land, they were less likely to engage in value addition. This is be attributed to the fact that farmers considered the cost of adopting the technology on a large farm size without evaluating the economies of scale that can be beneficial due to the large expanse of land. Similar results are reported by Orinda *et al.* (2017) who found that as land size increases, farmer's probability to adopt value addition activities in sweet potato production decreases and vice versa.

Household size is expected to influence farmers' decisions to invest nonfarm income in value addition activities positively because it acts as a proxy for farm labour. It was found to have a positive/negative and significant effect on the farmer's engagement into value addition activities at 1% and 5% probability levels respectively. The 5% significance level implied that large families were less likely to adopt value addition activities especially primary processing. The results imply that other factors held constant, if household size increases by one unit, the likelihood of participation in value addition decreases by 0.200 units The pessimistic prediction of family size on the adoption of value addition was

unanticipated after all, value addition is labour-intensive. The pessimistic prediction of family size on the adoption of value addition was unanticipated because the hypothesize was that large family sizes could be in a position to supply labour. After all, value addition is labour-intensive. The findings corroborated with Ehiakpor *et al.* (2022) who reported that family size negatively determines agricultural practices adoption. In the same vein, Mahama *et al*. (2020) note that large households often face a challenge of intra-household budget allocation in which food expenditure takes a large share of total household allocation, leaving less for other farming expenditures such as improved inputs.

The 1% significance level indicates that large families are likely to engage in value addition activities more so, secondary processing since value addition is labour- intensive as earlier mentioned. However, the findings disagreed with Mwaura *et al.* (2021) who found that family size positively influenced the utilization agricultural technologies.

Increased number of enterprises raised the probability of doing value addition at 1% and 5% significance levels. An enterprise in this case is defined as a component of crop farming that a farmer is undertaking. The results imply that other factors held constant, if the number of enterprises increases by one unit, the probability of participation in value addition increases by 0.759 and 0.214 units respectively These results imply that as the number of enterprises increase, a farmer's likelihood to engage in value addition increases. This was attributed to the fact that enterprise diversification is seen as a risk management strategy. Similarly, Nikaido *et al*. (2015) argued that specialization leads to instability of cash flow, this can be cushioned through full exploitation of technologies and savings generation to be used during occurrences of uncertainties.

Market access negatively and significantly influenced value addition activities at 5% significance level. The results imply that ceteris paribus, if access to production and market information increases by one unit, chances of participation in value addition activities decreases by 0.552 units. Increased distance to the market can have various effects on value addition. They include but are not limited to transportation costs and logistics.one of the primary challenges of increased distance to the market is the higher transportation and logistics costs involved in moving goods from the production facilities to the consumers. These costs can erode profit margins and reduce the potential for value addition. The results are in line with that of Behren *et al*. (2020) who examined the impact of distance on firm level productivity and found that higher transportation costs associated with increased distance to the market can negatively affect firm productivity and value addition.

4.6 Effect of investment of non-farm income on value addition decisions among smallholder farmers in Njoro sub- county, Nakuru county

4.6.1 Parameter estimates of value addition activities using multinomial logit model (First Stage)

Though the age of the household head influences value addition activities, it has a negative and significant impact on the likelihood of adopting secondary value addition activities at only 10% significance level as in Table 4.9. This suggested that young households are more likely than older farm households to adopt secondary value addition activities because they tend to be less risk-averse and have higher educational levels. The variable's negative effect suggests that older individuals have lower interest in secondary value addition. The outcome is comparable to Nkonki-Mandleni *et al*. (2022) who agreed with these findings.

At 5% significance level, the adoption of, pri-tert, and is positively impacted by the age of the household head though tert, pri-sec-tert were impacted positively at 10% significance level. This suggests that older farm households are more likely than younger farm households to adopt tertiary, primary tertiary, and primary-secondary-tertiary value addition activities. Older farm households had the ability to access, examine, and evaluate information regarding various agricultural technology, market prospects, and advantages of the technologies through their accumulated experience. According to the viewpoint, investigations by Choudhary *et al*. (2018) and Das *et al*. (2020) indicated that age had a favorable and substantial effect.

Larger farm households are more likely than their counterfactuals to adopt secondary, primary-secondary, secondary-tertiary, and primary_secondary_tertiary value additions as depicted in Table 4.9. This is indicated by the significant positive influence of household family size on the likelihood of adopting sec, pri-sec, sec-tert at 1% significance level, though for pri-sec-tert the adoption likelihood was at 10% significance level. This is because implementing these technology bundles requires and attracts additional laborers for agricultural pursuits. Gebre *et al*. (2023) had similar outcomes. Nonetheless, the outcome generally deviates from those of Ngongi and Urassa (2014) who observed a negative correlation between large household size and technology adoption.

At 5% and significance level, the likelihood of selecting pri-ter and was negatively and significantly impacted by farm size but it also influenced participation in pri-sec-ter at 10% significance level. It was proposed that farmers' decisions about value addition were influenced by farm size. An increase in the size of land among smallholder farmers in this

study indicated a lower likelihood of implementing a mix of primary-tertiary and primary-secondary-tertiary value addition techniques. In contrast, smallholder farmers with vast landholdings and resources are more likely to make decisions on adaptation because they can afford to introduce new agricultural equipment (Marie *et al*., 2020).

Increasing the number of enterprises raised the probability that the values pri-sec and pri-sec-ter would be added at the 1% and 5% significance levels, respectively. These results suggest that as the number of enterprises increase, the likelihood that a farmer engages in a combination of primary-secondary and primary-secondary-tertiary value-added increases. This is because enterprise diversification is considered a risk management strategy. Likewise, it can be argued that specialization leads to cash flow instability, which can be mitigated by extensive use of technology and the generation of savings that can be used in times of uncertainty. According to Nikaido *et al.* (2015), small farm enterprises are made more resilient through diversification when it comes to economic downturns hence are better positioned to receive steady cash flows that are steady enhancing loan accessibility and repayment.

On the other hand, increasing the number of enterprises reduces the probability of participating in the addition of sec, ter, and sec-ter by 1% and 5%, respectively. This may be because specialization benefits from economies of scale as the farmer invests all of his time and energy in a particular venture, which in turn increases his income. This elucidated that the more a farmer produces the less likely to engage in value-added activities as he would be getting more income from the sale of the produce that maximizing on the economies of scale. Nikaido *et al.* (2015) previously challenged this outcome stating that small scale farmers engage in value addition more as a result of specialization.

Time is positively and significantly associated with the probability of value creation, particularly in the case of secondary processing at 5% significance level. Though at secondary-tertiary processing, it is only significant at 10%. This is because a greater number of hours spent in non-agricultural activities increases the likelihood that the smallholder farmer will earn a higher income, which can then be spent on value-added activities. Farmers in Mau-Narok took time outside farming to engage in non-farm activities earned more income and eventually ploughed it to value-added activities. Chepkoech (2014) previously challenged this argument.

The need to maximize profit is positively and significantly associated with the probability of value addition at more so a combination of pri-sec-ter at only 10% significance level.

Table 4.9: Parameter estimates of value addition activities using multinomial logit model (First stage).

Variable	Sec	Tert	Pri-Sec	Pri-Tert	Sec-Tert	Pri-Sec-Tert
Gender	0.979	0.167	0.829	-0.143	0.768	0.150
	(0.656)	(0.694)	(0.783)	(0.403)	(0.562)	(0.486)
Age	-0.070*	0.061*	-0.032	0.048**	0.014	0.045*
	(0.039)	(0.033)	(0.046)	(0.019)	(0.028)	(0.023)
Maritalstatus	-0.229	-0.400	0.212	-0.176	-0.609	-0.389
	(0.456)	(0.581)	(0.776)	(0.294)	(0.509)	(0.442)
Size	0.619***	-0.157	0.623***	0.090	0.456***	0.274*
	(0.196)	(0.223)	(0.223)	(0.121)	(0.169)	(0.144)
Farmsize	0.397	-0.011	-0.274	0.256**	0.127	-0.374*
	(0.244)	(0.244)	(0.385)	(0.128)	(0.208)	(0.206)
Time	0.392**	0.045	0.043	0.088	0.312*	0.125
	(0.188)	(0.202)	(0.216)	(0.122)	(0.164)	(0.138)
Enterprise	-1.864***	-1.135**	0.201***	0.430	-0.829**	0.629**
	(0.535)	(0.538)	(0.609)	(0.259)	(0.386)	(0.309)
Profitmax	-0.383	0.451	-15.958	-0.590	0.562	-0.923*
	(0.719)	(0.733)	(1301.269)	(0.438)	(0.564)	(0.547)
Marketaccess	0.617	-0.087	-0.403	0.042	0.427	-0.455
	(0.753)	(0.725)	(0.834)	(0.434)	(0.643)	(0.519)
Phloss	1.031	-0.071	-0.771	-0.2617	-1.038	1.239**
	(0.821)	(0.882)	(0.938)	(0.492)	(0.652)	(0.630)
Shelflife	0.282	-0.146	-0.153	0.299	0.517	-0.328
	(0.709)	(0.891)	(0.913)	(0.493)	(0.638)	(0.554)
Hyprice	-1.296	-0.145	-0.603	-0.018	0.253	-0.324
	(0.928)	(0.875)	(0.279)	(0.506)	(0.576)	(0.602)
Credit	1.554	-0.267	1.223	0.209	16.68	0.923
	(0.998)	(0.917)	(1.041)	(0.549)	(1077.12)	(0.740)

Cons	-6.423*	-0.237	12.406	-0.982	-37.992	-5.514**
	(3.792)	(3.415)	(1301.274)	(1.861)	(2154.24)	(2.392)

Note: *, **, ***, denotes significance level at 10%, 5% and 1% respectively, () denotes standard error. Sec means Secondary, Tert represents Tertiary, Pri-Sec represents Primary and Secondary, Pri-Tert represents Primary and Tertiary, Sec-Tert represents Secondary and Tertiary, Pri-Sec-Tert represents Primary, Secondary and Tertiary.

This was informed by the farmers' zeal to increase revenue to invest in chamas/saccos, paying household bills, school fees, just to mention a few. This can be tied to the fact that increased profit margins are anticipated to boost farm income, enabling the household to reduce poverty, elevate food security not to mention elevate living standards of the rural farm households. This result corroborates with previous studies of (Agric Technical Working Group, 2022).

Minimization of post-harvest losses is positively and significantly associated with the probability of adoption of value addition activities especially pri-sec-ter at 5% significance level. The positive sign indicates that the more farmers are able to save their surplus produce, the more they would be willing to participate in adding value to their produce. Agric Technical Working Group (2022) agree with these findings. However, they differ from that of Tadesse *et al*. (2018) who indicated that farm households are less dependent on farming but instead preferred to engage in other economic activities.

4.6.2 Effect of investment of nonfarm income investment on value addition decisions

The effects of non-farm income on value addition decisions are shown in Table 4.10. This was done using the multinomial endogenous switching regression model which considered both ATT and ATU effects. The treatment effect measurement is a more meaningful but most importantly, it is an accurate approach to determining how useful innovation is among farming households (Kolapo & Kolapo, 2023). We compare expected income under the actual case that the farm household adopted a particular combination of value addition activities, and the counterfactual case that they did not; that is, we compare columns (A) and (B) of Table 4.10. Column (C) presents the impact of each VAA combination on household income, which is the adoption effect (ATT), calculated as the difference between columns (A) and (B). The income model was estimated jointly with the selection model that explains actors' participation in the various value chain activities.

Table 10: Average expected income from value addition activities

Value chain categories		Associated with a VAA (A)	Not Associated with a VAA (B)	Treatment Effects ATT/ATU (C)
Primary	Associated	16.13	15.16	ATT = 0.97***
	Not Associated	15.87	15.78	ATU= 0.09
	Heterogeneity effect	0.26	-0.62	0.88
Secondary	Associated	15.84	16.23	ATT= -0.38**
	Not Associated	15.97	16.23	ATU= -0.27*
	Heterogeneity effect	-0.13	0.00	0.11
Tertiary	Associated	15.92	16.34	ATT= -0.43***
	Not Associated	16.03	16.48	ATU= -0.45***
	Heterogeneity effect	-0.11	-0.14	0.02
Prim and Sec	Associated	15.74	16.20	ATT= -0.45***
	Not Associated	15.74	16.20	ATU= -0.45***
	Heterogeneity effect	0.00	0.00	0.00
Prim and Tert	Associated	15.96	16.18	ATT= -0.01
	Not Associated	16.05	16.15	ATU= -0.10
	Heterogeneity effect	-0.09	0.03	0.09
Sec and Tert	Associated	15.65	16.07	ATT = -0.42**
	Not Associated	15.91	16.20	ATU = -0.29**

	ed			
	Heterogeneity effects	-0.26	-0.13	-0.13
All practices	Associated	15.60	15.96	ATT = -0.35**
	Not Associated	15.75	16.17	ATU = -0.42***
	Heterogeneity effects	-0.15	-0.12	0.07

Note: *, **, ***, denotes significance level at 10%, 5% and 1% respectively.

Based on the findings in Table 4.10, smallholder farmers considered two different perspectives: firstly, those who utilized a single value addition activity such as primary processing, secondary processing, and finally, tertiary processing; secondly those employing more than one or all of the three value addition practices. The smallholder farmers participating in one value addition activity significantly increased their incomes compared to those who did more than one and those who participated in all the three practices.

Smallholder farmers increased their income after adding value to their produce under primary processing by 0.97 units. Smallholder farmers who chose secondary and tertiary processing; pri-sec, sec-ter and a combination of all the three processes reduced their monthly incomes by 0.38, 0.43, 0.45, 0.42, and 0.35 units respectively. However, smallholder farmers were worse off by engaging in a combination of pri-ter activities which reduced their income by 0.01 units This argument was previously challenged by Kolapo and Kolapo (2023) who concluded that farmers' productivity in terms of net income increased due to adoption of alternative package of conservation agricultural practices.

For counterfactual cases, households that adopted the value addition activities would have had both losses and higher incomes (ATU) had they not adopted the value addition activities. For instance, the ATU estimates for smallholder farmers would have decreased by 0.27, 0.45, 0.45, 0.10, 0.29 and 0.42 had they adopted secondary, tertiary processing; a combination of pri-sec, pri-ter, sec-ter and finally all the value addition activities respectively. Table 4.10 shows the results for ATT and ATU were positive and negative suggesting that some smallholder farmers achieved higher incomes while others experienced losses depending on the value addition activities they adopted. The smallholder farmers who participated in primary processing as a choice of value addition activity were positively and statistically significant at 1% significance level. Contrary, smallholder farmers who practiced

and secondary and tertiary processing; a combination of pri-sec, sec-ter and finally all the value addition reported a negative but significant ATT effect at 5%, 1%1% and 5% correspondingly, indicating that they were making losses.

For secondary, tertiary, a combination of pri-sec, sec-ter and all the value results on ATU had a negative and significant effect on household income at 10%,1% and 5% respectively. The results indicating losses had they participated in the aforementioned value addition activities. In the same way, the ATU results show a negative and significant effect participation in secondary value addition activities. Farmers who did not participate in secondary value adding would have earned 0.27 less income had they participated. Consequently, the household total income increased for farmers adopting each value addition practice in isolation compared to those adoption a combination of the value addition activities.

Overall, these results conclude that the highest income is obtained from participation in primary value chain activity had a positive and significant influence on household income, which is also greater than the effect of each practice jointly, suggesting that benefits are not complementary. The smallholder farmers participating in one value chain category significantly increased their profit margin. This implies that primary value chain activity increases household income for farmers. Thus, primary value activity is significant for delivering best results for the value chain actors. The findings agreed with Kpadonou *et al.* (2017) and Sileshi *et al*. (2019) who reported high adoption rates of at least one climate-smart agricultural practices (CSAP). Contrary findings were discovered by Teklewold *et al*. (2014) in Ethiopia were implementing a mix of Sustainable Intensification Practices (SIPs) increased net maize revenue in comparison to adopting them separately. In all counterfactual cases, farm households who actually adopted would have had a lower income had they not adopted [see column (B) of Table 4.10].

CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study's findings revealed that:

i. The nature of value addition activity that the farmers in Mau-Narok mostly preferred was primary processing. These included drying, sorting, cleaning, storage of raw produce for sale. Majority of the respondents participated in trade and sales as the main non-farm activity. In as much as the farmers practiced crop diversification, they mostly grew potatoes.

ii. Factors that positively influenced farmers' decision to engage in value addition were gender and age of the household head, time spent on nonfarm activities, credit access and household size had a whereas nonfarm income, production level, farm size, household size and market access had a negative influence.

iii. Lastly, it was found that primary value activity is significant for delivering best results for the value chain actors. This study provides empirical evidence that the adoption value addition activities especially primary processing by smallholder farmers can improve their financial performance let alone strengthen and stabilize the economic base of the farm.

5.2 Recommendations and policy implications

i. This study's findings indicate that the adoption of value addition activities has positive effects on household income, efforts should be directed towards sensitizing farmers to adopt alternative value addition activities. These programs should address specific value-addition techniques that align with the non-farm income sources of the households. Collaborate with local agricultural extension officers and cooperative heads to ensure that the training is practical and directly applicable to the farmers' activities. This will help them make informed decisions about investing their non-farm income into value-adding processes that are most relevant to their context.

ii. It would be crucial to create investment incentives and support mechanisms to encourage smallholder farmers to invest non-farm income into value addition activities. Local governments and financial institutions should work together to offer tailored financial products, such as low-interest loans or grants, specifically for value addition projects. Additionally, provide technical support and advisory services to help farmers navigate the investment process, select suitable technologies, and manage their investments effectively.

iii. To address issues of food insecurity and household income demands through sustainable smallholder agriculture in developing nations, value addition, nonfarm pursuits, and crop diversification can be viewed as an ex-ante solution.

5.3 Suggestions for further research

i. The study was limited to smallholder farmers in Mau-Narok ward, Njoro Sub-County. A similar study should be carried out in other parts of the Country to examine the level of non-farm income and value addition activities. As a result, strategies for value addition initiatives and, eventually, national food security might be developed more quickly and effectively.

ii. There is need to broaden the scope and investigate whether there are other factors besides socio-cultural and institutional that may affect participation in value addition in relation to nonfarm income.

iii. Although this study only covered value addition under three main value chains that smallholder farmers in Mau-Narok ward engaged in that is potatoes carrots and green peas, it is also equally important for future researchers to concentrate on other types of horticultural crops and livestock as well.

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APPENDICES

Appendix A: Survey questionnaire

It is a pleasure to notify you that this study is intended to determine the influence of participation in non-farm activities on the value-addition decisions of rural households **in your ward. Your responses will be treated as confidential and for research purposes only**.

PART (A): DEMOGRAPHIC INFORMATION

A1. Household heads name (optional).....

A2. Gender Male [ ] Female [ ]

A3. Age of household head.....years

A4. Marital status a) Single [ ] b) Married [ ] c) Widow [ ] d) Widower [ ] e) Separated [ ]

A5. What is the size of your household (number of family members)

a) Less than 18 yrs …… b) 18-60 yrs …… c) Above 60yrs…….

A6. (a) What is the size of your farm in acres?

a) 0.1-5 [ ] b) 6-10 [ ] c) 11-15 [ ] d) >15 [ ]

A7. Do you utilize all your farmland Yes [ ] No [ ] Give reasons

……

……

……

PART B: PARTICIPATION IN NON-FARM ACTIVITIES

B8. Does your household participate in non-farm activities? Yes [ ] No [ ]

B9. If

Yes, give reasons	No, give reasons

B10. If the answer is yes, who in your household participates in non-farm income generating activities?

a) The household head alone [ ]

b) The household head and spouse [ ]

c) Everyone in the household [ ]

B11. How many non-farm activities do you participate in as a household? Include activities for all members.

a) 1 [ ] b) 2 [ ] c) >2 [ ]

B12. Which non-farm income-generating activities do you participate in as a household? (Tick where applicable, you can tick more than one)

Trades and sales	**Artisan**	**Agro-processing**	**Extractive**	**Service**
Agrovet	Basket weaving (for carrying agric goods)	Posho mill	Timber cutting/ Lumbering	Harrowing
Dealing sisal ropes/firewood				Harvesting
Grocery stores				Spraying
Livestock trading				Transport of agric goods
Timber trading				
Tree selling				
Other(specify)	Other(specify)	Other(specify)	Other(specify)	Other(specify)

B13. How much time (hours) does your family allocate to non-farm activities in a day?

a) 0 to5 hrs [ ] b) 6 to 11hrs [ ] c) 12 to 18 hrs [ ] d) >18 hrs [ ]

B14. What is your average household income (KES) from non-farm activities per week?

0-500 [ ]

501-1000 [ ]

1001-2000 [ ]

2001-3000 [ ]

3001 and above [ ]

B15. Does this vary from season to season? [ ] Yes [ ] No

If yes how and why?

……

……

……

B16. How would you rate your household's participation in non-farm activities?

a) Very high (contributes more than 50% of household income) [ ]

b) High (contributes 50% of household income) [ ]

c) Moderate (contributes between 30 to 49% of household income) [ ]

d) Low (contributes between 11 to 29% of household income) [ ]

e) Very low (contributes less than 10% of household income) [ ]

B17. If production on your farm improved to give enough food for the family, would you continue with your non-farm activity? Yes [ ] No [ ]

Give reasons…….

B18. What benefits does the household derive from participation in non-farm activities?

……

……

……

B19. What do you think should be done to improve your participation in non-farm activities?

……

……

……

PART C: VALUE ADDITION INFORMATION

C20. How many agricultural enterprises do you operate? …….

C21. Which agricultural enterprises are you engaged in?

a) Potatoes b) Carrots c) Green peas d) Others (specify)……

C22.How many bags did you produce last season?

C23.Estimated size of the bags e.g 50kgs, 90kgs,120kgs

C24.How many bags did you sell after harvest?

C25.How much did you sell per bag?

C26. Do you add value to your products? [1] Yes [0] No.

C27. If yes, what is the motive?

a) Profit maximization b) Need to access more markets c) Minimize PH losses

d) Level of production e) Need to improve shelf-life f) Attract high product prices

g) Access more credit h) Others (specify)

C28. If no,

why? ……..……... C29.

What forms of value addition do you carry out on your commodity?

Primary processing	**Secondary processing**	**Tertiary processing**
Drying	Milling	Distribution
Sorting	Grinding	Cooking
Cleaning	Hulling	Packaging
Storage	Extracting	Branding
Oth- ers…….	Oth- ers……	Oth- ers……

C30.How much of the produce do you value add?.....

C31.After adding value how much doe the product go for?.....

C32. What challenges do you face while engaging in value addition activities?

……

……

……

C33. What do you think should be done to increase participation in value addition activities?

……

……

……

Thank you for your cooperation

Appendix B: Marginal effects estimates for factors affecting value addition activities using MNL

Marginal Effects Estimates for Factors Affecting Value Addition Activities Using MNL

Variable	Primary	Secondary	Tertiary	Prim_Sec	Pri_Tert	Sec_Tert	Pri-Sec_Tert
Gender	-0.030	0.038	0.006	0.022	-0.089	0.055	-0.003
	(0.051)	(0.032)	(0.030)	(0.025)	(0.058)	(0.039)	(0.045)
Age	-0.004*	-0.005***	0.001	-0.001	0.007***	-0.001	0.003
	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Marital Status	0.042	0.007	-0.007	-0.002	0.010	-0.024	-0.025
	(0.038)	(0.024)	(0.025)	(0.026)	(0.049)	(0.036)	(0.046)
Hhsize	-0.030**	0.023**	-0.016*	0.016**	-0.022	0.020*	0.009
	(0.015)	(0.009)	(0.009)	(0.007)	(0.016)	(0.010)	(0.012)
Farm size	0.022	0.027**	0.005	-0.004	-0.029	0.014	-0.036
	(0.016)	(0.012)	(0.010)	(0.013)	(0.022)	(0.015)	(0.022)
Time	-0.009	0.012	-0.008	0.004	-0.035**	0.023**	0.012
	(0.015)	(0.010)	(0.009)	(0.007)	(0.018)	(0.011)	(0.012)
Income	0.000	0.000	0.000*	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Enterprise	0.001	-0.096***	-0.047**	0.003	0.093	-0.042*	0.089***
	(0.031)	(0.027)	(0.024)	(0.019)	(0.034)	(0.024)	(0.025)
Profitmax	0.160	0.033	0.029	-0.540	0.138	0.145	0.032
	(8.452)	(4.307)	(1.258)	(45.43)	(0.065)	(4.716)	(9.600)
Marketaccess	-0.005	0.030	-0.010	-0.008	0.013	0.037	-0.056
	(0.055)	(0.038)	(0.030)	(0.027)	(0.065)	(0.047)	(0.049)
Phloss	-0.004	0.076*	0.003	-0.033	-0.105	-0.097**	0.160***
	(0.060)	(0.040)	(0.038)	(0.029)	(0.068)	(0.041)	(0.057)
Production	-0.021	0.004	0.030	-0.024	-0.069	0.029	0.050
	(0.054)	(0.041)	(0.038)	(0.029)	(0.060)	(0.049)	(0.050)
Shelflife	-0.026	0.006	-0.004	-0.014	0.044	0.047	-0.052
	(0.062)	(0.034)	(0.039)	(0.030)	(0.071)	(0.043)	(0.050)
Hyprice	0.024	-0.070	0.006	-0.015	0.034	0.046	-0.025
	(0.064)	(0.049)	(0.038)	(0.043)	(0.075)	(0.045)	(0.056)
Credit	-0.341	-0.166	-0.153	-0.019	-0.421	1.288	-0.184

	(19.589)	(15.434)	(6.946)	(4.095)	(28.069)	(90.432)	(16.297)

Note *, **, ***, denotes significance level at 10%, 5% and 1% respectively, () denotes standard error

Appendix C: Research permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **287073**

Date of Issue**30/June/2023**

RESEARCH LICENSE

This is to Certify that Ms.. Winnie Atieno Ooko of Egerton University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nakuru on the topic: EFFECT OF NON-FARM EMPLOYMENT ON VALUE ADDITION DECISIONS AMONG SMALLHOLDER FARMERS IN NJORO SUB-COUNTY, NAKURU COUNTY, KENYA for the period ending : 30/June/2024.

License No**NACOSTI/P/23/27053**

287073

Applicant Identification Number

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See overleaf for conditions

Appendix D: Research ethics clearance

EGERTON UNIVERSITY

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EGERTON

EGERTON UNIVERSITY INSTITUTIONAL SCIENTIFIC AND ETHICS REVIEW COMMITTEE

EU/RE/DIR/009
Approval No. EUISERC/APP/232/2023 ***24th April 2023***

Winnie Atieno Ooko
P.O. Box 536-20115
Telephone: +254 (0) 798280021
E-mail: winzooko@gmail.com

Dear Winny,

RE: ETHICAL APPROVAL: EFFECT OF NON-FARM EMPLOYMENT ON VALUE ADDITION DECISION AMONG SMALLHOLDER FARMERS IN NJORO SUB-COUNTY, NAKURU COUNTY, KENYA.

This is to inform you that ***Egerton University Institutional Scientific and Ethics Review Committee*** has reviewed and approved your above research proposal. Your application approval number is ***EUISERC/APP/232/2023.*** The approval period is ***24th April, 2023 –25th April, 2024***

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***Egerton University Institutional Scientific and Ethics Review Committee.***
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***Egerton University Institutional Scientific and Ethics Review Committee*** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to ***Egerton University Institutional Scientific and Ethics Review Committee*** within 72 hours.
v. Clearance for Material Transfer of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.

Appendix E: Publication abstract

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Rural Non-Farm Income And Value Addition Decisions In Nakuru County, Kenya: A Multivariate Probit Approach

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Abstract:
Background: *Smallholder agriculture is typified by inadequate value addition and an inability to meet the growing needs of both domestic and foreign markets. Several issues limit farmers' ability to produce outputs in amounts and quality forms that are marketable and commercially viable. Some significant limitations include a lack of proper storage and processing facilities. In order to make rural agribusiness actors more competitive and ultimately increase their incomes, rural households have diversified their income sources by engaging in both agricultural and non-farm enterprises. Several studies have determined the impact of non-farm employment on smallholder farmers' welfare and the determinants and effects of value addition on household income. However, none of such studies has discussed the link between participation in non-farm employment and value-addition decisions. This study aimed to determine whether participation in non-farm activities significantly affects rural households' value-addition decisions. This investigation, therefore, established the drivers for the investment of non-farm income in value-addition activities among smallholder farmers.*
Materials and Methods: *This study used cross-section data to examine the factors that lead rural households in Nakuru County's Mau-Narok ward to participate in value addition due to non-farm income investment. Both primary and secondary data were gathered. Multistage sampling was used to get primary data from 245 sample respondents. This study included both econometric and descriptive analysis. The sample households were characterized by institutional, demographic, and economic characteristics using descriptive statistics. A multivariate probit model was employed to estimate the factors influencing non-farm income investments in value-adding decisions.*
Results: *The findings revealed that production level, farm size, household size and market access significantly and negatively influenced participation, while gender and age of the household head, time spent on non-farm activities, credit access, non-farm income and household size significantly and positively affect rural household non-farm income investment in value addition activities.*
Conclusion: *This study concludes that farmers' participation in non-farm pursuits influences their choices to create value. The study's conclusions suggest that to promote agricultural development in Nakuru and other counties with comparable features, agricultural policies should include measures that provide opportunities for the non-farm sector, leading to increased producer market involvement.*
Key Word: *Investment; Non-farm activities; Household income; Multivariate probit model.*

Date of Submission: 08-07-2024 Date of Acceptance: 18-07-2024