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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.*

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I. Introduction

It is well known that agriculture is a significant factor in promoting macroeconomic and microeconomic transformation in developing economies. However, recent developments show that most emerging countries are seeing the growth of parallel businesses overtaking the agriculture sector in importance. One of these areas that has gained significance in development economics research is the rural non-farm sector[1]. It has been shown that the non-farm sector in rural areas has a favourable impact on the development outcomes of rural communities. Dedehouanou *et al.* state that revenue from non-farm activities can increase average household income, lessen household capital and credit constraints, and increase farmers' ability to acquire inputs for their farms and adopt new production methods[2]. On the other hand, value addition has become more popular recently since it increases and stabilizes farm revenues, revitalizes primary farming production, and strengthens rural economies[3]. This realization not only increases the manufacturing structure of agricultural enterprises and gives farmers more financial stability by allowing them to penetrate niche markets but also gives rural communities better jobs and prospects for a fresh start[4]. Abend posited that decision-making is a necessary component of choice[5]. In contrast,

Parsons depicted choice in agriculture as a process aimed at giving agricultural producers a solid basis for continuously making wise choices in a highly competitive and ever-changing environment[6]. Moreover, research has yet to focus on the value-adding investment of non-farm revenue. Therefore, this study aims to identify factors that drive rural farm households to engage in value addition due to non-farm income.

II. Material And Methods

This study examined the factors that lead rural households in Nakuru County's Mau-Narok ward to participate in value addition due to non-farm income investment from March to August 2023. A total of 245 smallholder farmers (both male and females) aged ≥ 18 years were considered for this study.

Study Design: Cross-sectional descriptive survey study

Study Location: The study was conducted in Mau-Narok Ward of Njoro Sub-County, Nakuru County. It lies in the Mau escarpment and covers an area of 166 square kilometres. Its altitude is 2100-2800m above sea level, and it receives an annual rainfall of 1600-2200 mm. The rainfall pattern is bimodal, with long rains from March to August and short rains from October to December. Agroecological zones are the Upper Highlands and Lower Highlands. Mau-Narok has a population of 11,806 people (Males - 5,810 and Females - 5,995). The main crops grown in Mau-Narok are maize, potato, carrots, green peas, beans and vegetables. Livestock kept include cattle, sheep and local chicken. The people's livelihoods in the area vary, but the primary income-generating activities are livestock and crop farming. Off-farm activities include businesses and salaried employment[7].

Study Duration: March 2023 to August 2023.

Sample size: 245 smallholder farmers.

Sample size calculation: The sample size was estimated based on a cross-sectional descriptive survey design. The target population from which we randomly selected our sample was considered 52,696. Participants were collected in each location after using Cochran's formula (1977) to determine the sample size in each location. This study desired a 95% confidence level and a 5% precision level with a z score 1.96. In this study, no exact number (per cent) of farm households participated in non-farm activities in the Mau-Narok ward. Therefore, an arbitrary maximum variance of 0.8 was employed. The derived sample size for the study was 245 respondents.

Subjects & selection method: The target population was smallholder farmers engaging in non-farm employment and value-addition activities in Mau-Narok, Njoro sub-county, Nakuru County. In this study, a multi-stage sampling procedure was employed. In the first stage, Njoro sub-county was selected purposively due to different non-farm activities in the area, which accounts for 80% of rural farm households[8]. In the second stage, the Mau-Narok ward was selected due to the considerable number of farmers in the area. Lastly, four locations in Mau-Narok ward were selected as they had farmers engaging in non-farm activities and value-addition practices.

Inclusion criteria:

1. Smallholder farmers participating in both nonfarm and value addition activities

Exclusion criteria:

1. Smallholder farmers participating in nonfarm only
2. Smallholder farmers participating in value addition only

Procedure methodology

On obtaining an informed consent, Primary data was collected from 245 respondents using semi-structured questionnaires which were administered by trained enumerators. A pilot test of the questionnaire was first carried out to determine its suitability and validity for the study. The data collected included the farmer group characteristics, institutional characteristics, information on value addition, marketing, product prices, output and cost of product sales. data from quantitative sources was used in the study to test and describe the relationship between rural nonfarm income and value addition decisions.

Statistical analysis

For the purposes of analysis, collected data was cleaned and coded to ensure consistency, uniformity and accuracy. The data was used to generate descriptive, inferential and econometric results and it was managed using STATA software.

The objective of this study was to provide empirical evidence on the drivers for the investment of income from non-farm sources in value addition activities among smallholder farmers in Mau-Narok ward, Njoro Sub- County in Nakuru county.

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, achieving high product prices, access to finance, production level, type of enterprise and improving 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 reference 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[9]. 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 were not mutually exclusive and there was a possibility of simultaneous correlations among these factors, based 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[10].

The decision of whether or not to invest income from nonfarm sources in value-addition activities was assumed to be on the principle of profit or utility maximization[11]. Given a smallholder farmer *i* in deciding on 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 zth 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 value addition activities if Y*iz = U*z – U > 0. 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 ($\boldsymbol{\varepsilon}_i$).

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

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

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

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[9]. This presumption implies that the above condition produces a multivariate probit model that addresses 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 income from non-farm sources in value-addition activities was estimated as;

$\mathbf{Y_{iz}}$**=** $\beta_0 + \beta_1$ Profmax + β_2MinPHL + β_3HighPP + β_4Impshlif+ β_5Accmkts + β_6ToE + β_7Prodl + β_8Finance + ε_i

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

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

Table no 1: 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			
Promax	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	+/-

III. Result

Descriptive Results

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 Table 2. The household characteristics analysed 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 minimise post-harvest loss, market participation.

According to the results in Table 2, the average age of the household head was 43.69 years, which was statistically significant at 1% (p = 0.000). At the same time, the average age of the households involved in primary, secondary, or tertiary value-addition activities was 44.06, 43.87, and 44.74 years, respectively.

According to the statistics, most household heads (56.33%) who participated in value-addition activities were men. A little over 58.7%, 51.5%, and 57.3% of men worked in primary, secondary, and tertiary value-addition activities. There was no significant relationship between gender and the likelihood of farmers' participation in value-addition activities at $p<0.05$.

By comparison with single farmers, married farmers engaged in primary, secondary, and tertiary value-addition activities at rates of 83.7%, 81.8%, and 80.1%, respectively, as shown in Table 2. Most married farmers (81.2%) participated in value-addition activities. There was no significant relationship between marital status and the likelihood of farmers' participation in value-addition activities at $p<0.05$ level.

Among these farmers, the average household size was approximately five members. Those who participated in primary, secondary, and tertiary value-addition activities had average household sizes of 4.8, 5.6, and 5.0, respectively. At 10% (p=0.087), household size substantially impacted value-added activities.

A farmer involved in primary, secondary, or tertiary value chain activities had an average farm size of 1.76, 1.65, or 1.66, respectively. In contrast, the average farm size was 1.75. There was no significant relationship between farm size and the likelihood of farmers' participation in value-addition activities at $p<0.05$.

The mean duration of non-farm activities for actors was 6.83 hours, which was significant at 1% (p = 0.005). On the other hand, they spent 6.65 hours, 7.36 hours, and 6.78 hours on primary, secondary, and tertiary activities each.

Value adders made an average of around KES 23,566 non-farm income each month. Actors in secondary activities made more money (KES 25,424) than those in tertiary processing (KES 23,913) or primary activities (KES 21,453). At 5% (p = 0.010), the income disparity between these groups was statistically significant.

The average number of enterprises owned by farmers was 2.24 and was statistically significant at 1% ($p=0.000$). In contrast, the enterprises owned by actors involved in primary, secondary, and tertiary value chain activities were 2.42, 2.13, and 2.34, respectively.

It was determined that 34.69% of the value chain actors were involved in the market. Only 38.64%, 31.31%, and 34.34% of value chain participants, respectively, were involved in primary, secondary, and tertiary value-addition activities. There was no significant relationship between market participation and the likelihood of farmers' participation in value-addition activities at $p<0.05$.

Findings in Table 1 below showed that the need to reduce post-harvest losses concerned 38.37% of value chain participants and was significant at a 10% (p=0.071) level. Furthermore, only 38.59%, 32.32%, and 37.95% of primary, secondary, and tertiary value chain actors worried about the necessity of minimising post-harvest losses.

According to the results, 48.57% of value chain participants were concerned about extending the product's shelf life. This finding showed that about 50%, 50.51%, and 47.59% of value chain participants involved in primary, secondary, and tertiary value chain activities worried about increasing shelf life. There was no significant relationship between the need to improve shelf life and the likelihood of farmers' participation in value-addition activities at $p<0.05$.

The requirement to attract a high market price is a concern for the majority of value chain participants (78.37%). About 78.26%, 79.80%, and 77.11% of the value chain participants at primary, secondary, and tertiary, respectively, were worried about the requirement to draw a high market price. There was no significant relationship between the need to attract high prices and the likelihood of farmers' participation in value-addition activities at $p<0.05$.

Out of all the value chain actors, 16.33% could obtain credit, according to the results. However, only roughly 18.48%, 9.09%, and 13.86% of value chain actors, primary, secondary, and tertiary, could obtain credit. A statistically meaningful amount of credit was available to these value chain participants at 10% (p=0.093).

Table no 2: 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 allocated to 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 participation						
	34.69		38.04	31.31	34.34	0.487
Need to minimize post-harvest loss						
	38.37		38.59	32.32	37.95	0.071*
Need to improve Shelf life						
	48.57		50.00	50.51	47.59	0.379
Need to 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)

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

The household head's gender positively predicted the adoption of value-addition activities at a 10% significance level, as shown in Table 3. 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.

Age is positively and significantly correlated with the probability of participation in value-addition, particularly tertiary processing, at a 5% significance level. The results imply that ceteris paribus increases the chances of participation in value-addition activities by 0.021 units if the household head's age increases by one unit.

Time is positively and significantly associated with the probability of value addition, especially secondary processing, at a 5% significance level. The results imply that ceteris paribus, if the time taken to undertake non-farm activities increases by one unit, the chances of participation in value addition increases by 0.124 units.

The increase in income only significantly affects investment in primary value addition positively at a 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 0.834 units.

Production level is associated negatively and significantly with value-addition at the 5% level. The results imply that other factors are held constant; if the production level increases by one unit, the likelihood of participation in value addition decreases by 0.652 units.

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.

The 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. 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 and vice versa. The results show that the likelihood of adopting value-addition practices decreases with the increasing size of farms.

Household size was found to have a positive/negative and significant effect on the farmer's engagement in value-addition activities at 1% and 5% probability levels, respectively. The results imply that other factors are held constant, if household size increases by one unit, the likelihood of participation in value addition decreases by 0.200 units.

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 mentioned earlier. The results imply that ceteris peribus, if the production level increases by one unit, the likelihood of participation in value addition increases by 0.153 units.

The increased number of enterprises raised the probability of doing value-addition at 1% and 5% significance levels. The results imply that other factors are 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.

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 decrease by 0.552 units.

Table no 3: 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
Gender	-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	.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

IV. Discussion

Household demographics

Older people's propensity for extensive networking and wealth of experience accounts for most of their engagement in value-added activities. As a moderating variable, age was looked into as it has been noted to drive farmers' decisions and participation in the adoption of technologies, in this case, value addition being the technology of choice. Therefore, this study found that the age of the smallholder farmers influenced value-addition activities as it requires energetic individuals to thrive, given the logistics involved. Their years of experience in farming make them more qualified, as previously noted by Afande et al.[12].

This study's findings implied that large families were more likely to add value. Household size as a variable is core as it is a proxy for labour availability to facilitate agricultural practice. The optimistic prediction of family size on adopting value-addition was anticipated because the hypothesis was that large family sizes

typically supply labour. After all, value addition as a technology is labour-intensive. Greater household sizes aid in labour provision by supplying the workforce required to add value, as Odoemelam et al. reiterated[13].

Another measure was the amount of time value adders spent on non-farm activities. Farmers in the study area ensured that they allocated several hours after engaging in their normal day-to-day farm activities to engage in the non-farm activity of their preference. This realization ensured that their income flow was stable, encouraging them to participate in the particular value addition activity they saw fit. A household allocates its total time endowment among farm work, non-farm activities, market work, and leisure[14].

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 due to improved purchasing powers. This postulation agrees with Musyoka et al. and Woldeyohanes et al., who concluded that higher off-farm incomes enhance agriculture commercialization by smallholder farmers if used as a source of liquidity for farm investments[15,16].

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, 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 realization allowed them to earn more income than they would have while selling raw products.

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, elevating their profit margins due to the value-addition activities they embraced. This realization agrees with the findings highlighted in the Agric Technical Working Group Partners research[17].

Acquiring new agricultural technologies requires credit. Orinda et al. were in agreement with these findings[18]. 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 could 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 adoption of value-addition activities at a decreasing rate, as it was evident that most of them engaged in primary processing, which does not require much capital to facilitate the processes required.

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

The results suggested that male-headed smallholders tended to intensify value-addition practices more 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. The results also corroborate those of Oyetunde-Usman et al., who reported that male-headed households intensified sustainable agricultural practices and attributed it to poor access to complementary inputs[19]. The positive prediction aligned with previous literature that male dominates farming resources.

According to Dimelu et al., age is crucial when making decisions that may affect one's livelihood[20]. Additionally, a person's age represents their level of maturity, which determines their capacity and interest in engaging in particular activities. These findings implied that older farmers 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., who reported that older farmers were less involved in value addition in the cassava value chain in Nigeria[21].

Time is positively and significantly associated with the probability of value addition. This realization is attributed to the fact that the hours utilized in non-farm activities increase the likelihood of a smallholder farmer earning more income, which can eventually be diverted to value-added activities. This was informed by the fact that the farmers were willing to dedicate part of their time to engaging in activities other than farming to boost the income they get from farming activities, ultimately investing it in value-added activities. Chepkoech previously challenged this argument[13].

An increase in non-farm Income significantly affects investment in value addition. 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. found that off-farm income positively correlated with mango farm-level value addition in Kenya[14].

Access to credit had a positive coefficient and significantly affected farmers' participation in value-addition activities. This is because access to credit supports farmers' finances if they wish to engage in value addition activities or any other activity they wish to embrace. 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. and mango farmers in Kenya Musyoka et al.[20,14]. Based on these previous studies, we expected the use of credit to be positively correlated with participation in value addition, as these activities require capital investment. The credit helps smallholder farmers with limited capital overcome liquidity constraints and increase their capital, which can be invested in value addition.

The positive sign associated with the farm size of the households 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. 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 can 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., who found that farmers' probability of adopting value-addition activities in sweet potato production decreases as land size increases and vice versa[17].

Household size is expected to positively influence farmers' decisions to invest nonfarm income in value addition activities 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 in value addition activities. The pessimistic prediction of family size on adopting value addition was unanticipated, as value addition is labour-intensive. The findings corroborated Ehiakpor et al.'s findings, who reported that family size negatively determines agricultural practices adoption[22]. Similarly, Mahama et al. 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[23]. On the other hand, the positive coefficient indicates that large families are likely to engage in value addition activities, more so secondary processing, since value addition is labour-intensive, as mentioned earlier. However, the findings disagreed with Mwaura et al., who found that family size positively influenced the utilization of agricultural technologies[24].

In this case, an enterprise is defined as a component of crop farming that a farmer is undertaking. These results imply that a farmer's likelihood to engage in value addition increases as the number of enterprises increases. This was attributed to enterprise diversification being seen as a risk management strategy. Similarly, it can be argued that specialization leads to instability of cash flow, which can be cushioned through the full exploitation of technologies and savings generation to be used during occurrences of uncertainties. This is in line with the findings of Nikaido[25].

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 those of Behren et al., 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[26].

V. Conclusion

The basis of this study was to determine factors influencing the choice of nonfarm income to boost value addition by smallholder farmers in Mau-Narok ward, Nakuru County. Three types of value-addition activities were identified namely primary, secondary, and tertiary processing. The investigation revealed that the choice to invest nonfarm income in value addition activities and primary activities was influenced by household size, farm size, production level, enterprise income, and market access, respectively. The choice of secondary value addition is influenced by gender, household size, time spent on nonfarm activities, and credit access. Lastly, the choice of tertiary value addition is influenced by age, farm size and enterprise. This concludes that gender, age, household size, farm size, time spent on nonfarm activities, nonfarm income, enterprise, market access, production level, and credit access led the smallholder farmers to choose the three value addition activities previously identified. In order to optimize their impact, smallholder farmers should pay extra attention to the important variables, particularly those that positively affect value-addition activities, as indicated by this study's findings.

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