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A Multinomial Logit Approach to Smallholder Milk Marketing Channels for Improved Competitiveness in the Kenyan Dairy Value Chain

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Abstract: Selection of appropriate markets is a major challenge facing smallholder dairy farmers in Kenya. This study therefore sought to understand factors influencing milk marketing channel choices among smallholder dairy farmers in Kinangop Sub County. Data from a sample of 230 smallholder dairy farmers was collected using structured questionnaires and analysed using both descriptive and inferential statistical methods. The study identified three marketing channels namely; milk processors (46.09) %, milk bars (32.61) % and direct sales (21.3) %. Similarly, years of schooling ($p \leq 0.1$), on-farm income ($p \leq 0.1$) and milk output ($p \leq 0.01$) were statistically significantly different across the three marketing channels. The average farm gate price was kes 32.6 per litre. From the multinomial logistic regression, marital status, extension access, association membership, mode of payment and transport ownership significantly influenced marketing channels. Further results showed that majority (53.48) % of farmers never had access to market information. The study therefore recommended policies geared towards enhancing more years of formal education and market intelligence so as to facilitate selection of appropriate marketing channels, more training on dairy husbandry practices with the aim of increasing milk output, facilitate access to transport facilities so as to enhance milk delivery to milk collection centres and a review of payment arrangements between milk processors and farmers so as to avoid the problem of delayed payments to farmers.

Keywords: Kinangop Sub County, Milk Marketing Channel, Multinomial Logit Model, Smallholder Dairy Farmers

1. Introduction

The role of livestock market chains towards enhancing livelihoods of farmers is of significant value since it contributed to the employment of about 1.3 billion people globally besides having an asset value of US$1.4 [22]. In developing countries, livestock farming supports over 600 million smallholder farmers hence considered as an important risk management strategy for smallholders [36, 22]. In sub Saharan Africa, livestock farming has still continued to be a major source of livelihood and a major driver to pro-poor change of about 80% of smallholder farmers [34, 7]. Approximately (12-14) % of the world population derives their livelihoods directly from dairy farming [13]. India, Europe, the United States of America, New Zealand, and Australia being the major dairy exporters while Russia, China and Mexico being the main importers of dairy and dairy products [13]. Global milk production stood at 659 million tonnes of fresh cow milk, 6% being produced from Africa [11]. East Africa led by producing 68% of the continent's milk output [5] and 43% of cow milk [24, 11]. The report further put Ethiopia, Kenya, and Tanzania among the largest dairy producers in Africa. In Kenya, the dairy sub-sector contributed 40% of

the agricultural GDP and 4% of the national GDP and experienced an annual growth rate of about 3 to 4% [21]. Sale of milk accounted for a gross value of Ksh. 257.811 billion Kenyan shillings, which is about 70% of the total gross value of livestock's contribution to the agricultural sector [16]. The growth of the dairy sub-sector has been attributed to more demand for dairy and dairy products which has created an enormous opportunity to invest more within the dairy value chain especially in value addition [4]. Sale of dairy products contributed about 30% of the livestock Gross Domestic Product (GDP), more than 22% of livestock gross market value and supports approximately 1.8 million households in rural areas in Kenya [12]. Similarly, the annual growth rate in milk consumption was estimated at between (2-3) % [5]. Dairy marketing system being characterised by a growing demand for value added products such as milk powder, ghee, yoghurts and cheese [36, 29, 23].

An enormous marketing opportunity was created for the Kenyan dairy products through elimination of terrify barriers in the East African Community as well as regional integration between the East African Community (EAC), Common Market for Eastern and Southern Africa (COMESA) and Southern African Development Community (SADC). However, low inputs and yields continue to be the main obstacles hindering the growth of the sub-sector [38, 6]. Similarly, previous policy documents such as vision 2030, agricultural sector development strategy and the national agribusiness strategy focused on strategies towards enhancing the competiveness of smallholder dairy farming and marketing systems, however, the dairy sub sector is still faced with challenges such as information asymmetry, infrastructural challenges, transaction cost barriers, policy induced barriers as well as social and non-economic factors [14]. Nxumalo et al. [33] identified challenges such as interior and dispersed locations of smallholder dairy households, unreliable infrastructure to be having an incremental effect on the marketing costs which further limits access to both input and output markets. Poor pricing system, inability of local markets to absorb supply, low output prices and inefficient marketing institutions as the main constraints to marketing among farmers [9]. In Kinangop region, dairy farmers are unable to efficiently market their milk due to challenges such as; poor infrastructure which increases the transaction costs, inefficient forms of transportation such as use of animals which delays milk delivery, inadequate accessibility to farm inputs and fluctuating milk prices [25, 15]. Overcoming these limitations necessitates a better understanding of the determinants of marketing channel choice so as to facilitate identification of potential pathways for improving the competitiveness of smallholder dairy farming systems.

General objective

The overall objective of this study was to explore the determinants of milk marketing channels among smallholder dairy farmers in Kenya.

Specific objectives

The following specific objectives guided the study:

1. To characterize the socio-economic profile and milk marketing channels among smallholder dairy farmers in Kinangop Sub County.
2. To explore the determinants of milk marketing channels among smallholder dairy farmers in Kinangop Sub County.

2. Literature Review

Adequate market access is central in smallholders' livelihood improvement since it creates more demand for farm products [2]. Markets can be classified as either formal and informal, informal markets being highly preferred by smallholders' due to closeness of proximity and ease of price negotiations between the buyers and sellers [10]. This market is characterized by subsistence production, unofficial transactions, absence of formal grades, traceability and standard measure which compromises on milk quality [27, 16]. Whereas formal markets operate under a highly regulated environment where transactions are agreed upon based on clearly defined legal frameworks [10]. This market is characterized by clearly defined grade system, product quality standards, safety guidelines, active value chain systems that links smallholders to commercial [20, 3]. Formal milk markets conform to the minimum standards and modern technologies in milk processing while informal markets mostly handle row milk and traditionally unprocessed products [22]. Informal markets are highly preferred by farmers due to their relatively lower transaction costs [27]. Different researchers for instance Wanjala et al. [35] assessed the structure and performance of the milk markets in Western Kenya and found 70% of marketed milk to come from the informal markets. Nyaga et al. [34] identified selling to neighbours, direct sales to the market and selling to traders as the main marketing channels among fish farmers in Kirinyaga County, Kenya. In their study selling to neighbours had the highest preference followed by direct sales and selling through traders. Mutura et al. [30] employed a multinomial logit model to analyse the determinants of dairy market outlet (farm gate, middle men, direct sales) among smallholder dairy farmers in Lower Central Kenya and revealed education level, milk output, information access and transaction costs as significant and positively influencing choice of milk sales. Nyaga et al. [34] clustered the markets into three categories; neighbours, direct sales and traders and employed the multinomial logit model to assess how choice decisions are influenced by a set of factors in Kirinyaga County, Kenya. From the results, household head, distance to market place; land tenure, number of fish ponds owned, extension access, cost of marketing, membership to farming association, access to inputs, income of household, fish prices and breed of fish were significantly influencing farmers' choice of marketing channel.

Based on the Hackman model, [27] revealed a positive

impact of selling through cooperatives on both farmers' annual total household income and farm income. Following the probit model farm size, farming machine ownership, distance to market, credit constraint, sale condition, motivation to participate in agricultural cooperatives and the knowledge of agricultural cooperatives were significant and positively influenced the decision to sell through agricultural cooperatives, whereas market information had a negative effect on the choice of marketing channel. Afari-Sefa et al. [1] assessed how markets provided by farmer organizations imparts on the income of smallholder vegetable farmer's in Tanzania using the propensity score matching. From the logit estimates, gender, household head, farm size and distance to market place were significantly influencing the decision to participate in the market. Mbando et al. [29] examined the determinants of marketing channel choice (traders, brokers, wholesalers) among smallholder maize and pigeon pea farmers in the northern and eastern zones of Tanzania and applied a multinomial logit model which revealed transaction costs, household wealth, access to credit and extension services, and social capital to be significantly influencing marketing channel choice options. Tawanda et al. [37] employed a multivariate probit model to examine factors influencing tomato smallholder market outlet choices in Ethiopia and classified marketing channels into three categories namely; wholesalers, retailer and consumers. From the descriptive results, retailers were highly preferred by tomato farmers followed by wholesalers and consumers respectively. Results from the multivariate probit revealed transaction cost, credit access, household size, age, formal schooling, farming experience and quantity of tomato produced to be significantly influencing marketing channel choices. Tawanda et al. [37] examined the determinants of smallholder producers' potential to sell cattle and applied the binary logit model which revealed household size, age, farmers' denomination, flock size, income and extension access to be positively influencing the likelihood of selling cattle. From the descriptive analysis, beef branding was the most preferred marketing strategy for improving commercial marketing of cattle followed by feedlotting, joint marketing as a group and forward contracts respectively. Nxualo et al. [33] in their study on factors influencing marketing channel choice among maize and sunflower farmers in South Africa employed the multinomial logit model which revealed age, marital status, gender, credit access, education, and farming experience to be significant in explaining choice probabilities of marketing channels. [26] employed the propensity score matching to explore factors determining choice of market facilitators by smallholder horticultural farmers in Laikipia County, Kenya and found gender and distance to output market as having a positive and significant influence on choice of market facilitators whereas other factors such as number group members, information access, purpose of farming and quantity of farm output negatively influenced choice of market facilitators. From the descriptive analysis, farmers mostly relied on traders to aid marketing of their farm produce, similarly, radio and television was widely used as instruments for information access. Ntimbaa et al. [32] in their study employed the multinomial logit model to assess the determinants of marketing choice decision by coffee farmers in Tanzania and revealed households head age, price of dry coffee cherry and distance to selling centre to significantly influence choice decisions. The study further identified three marketing channels namely; Rural Primary Societies, Private Coffee Buyers and Village buyers and that private coffee buyer were greatly preferred due to the relatively higher prices they offered as opposed to other marketing options.

Theoretical Framework

This study is anchored on the utility theory which assumes that the economic agents are rational and tend to select marketing channels that maximizes their underlying utility function. Hence farmers marketing channels can be conceptualized using a Random Utility Model (RUM) which models smallholder farmer's choice decisions based on utility maximization theory. Farmer's selection decisions are guided by perceived utility, in consideration of benefits and costs towards market channel selection. Following Mmbando et al. [28], if the X_{ij} farmer observes C (3) market channels (milk processors, milk bars, direct sales) then the utility derived from selecting the j^{th} marketing channel will be denoted as U_{ij}. The marginal benefits must outweigh the marginal costs associated with the selected marketing channel and since utility cannot be observed directly, farmers' choices will reveal the choice alternatives with the greatest utility. Utility U_{ij} derived by the i^{th} farmer through selecting the preferred alternative is therefore specified as a linear function of a vector of channel-specific parametersβ_{ij}, the attributes of that particular alternative X_{ij} and a stochastic error componente_{ij}. Smallholder dairy farmers will select a specific marketing channel if their expected utility exceeds the utility from pursuing either of the other channels hence:

$$U_{i(j-k)} = \beta_{i(j-k)} X_{ij} + e_{ij} \quad (1)$$

3. Materials and Methods

3.1. Study Area

The study was conducted in Kinangop Sub-County within the Central highlands of Kenya. The area experiences moderate to low temperatures of 25°C in December and 12°C in July and has two rainy seasons, the long rains from March to May with a maximum rainfall of (1600) mm and the short rains from September to December (700) mm. The main dairy cooperatives are: Muuki SACCO, Tulaga SACCO, South Kinangop dairy, Kitiri dairy, Njabini dairy farmers' cooperative, Karati, Umoja victory, Bamboo farmers' cooperative and Gidhiolo farmers' cooperative [8]. Milk cooling and processing are the main value addition activities in the area majorly being done on a small scale basis [25, 8].

The site was selected due to the high intensity of dairy farming. Friesian being the main livestock breed, other breeds include: Guernsey, Jersey and Ayrshire.

Kinangop Sub County

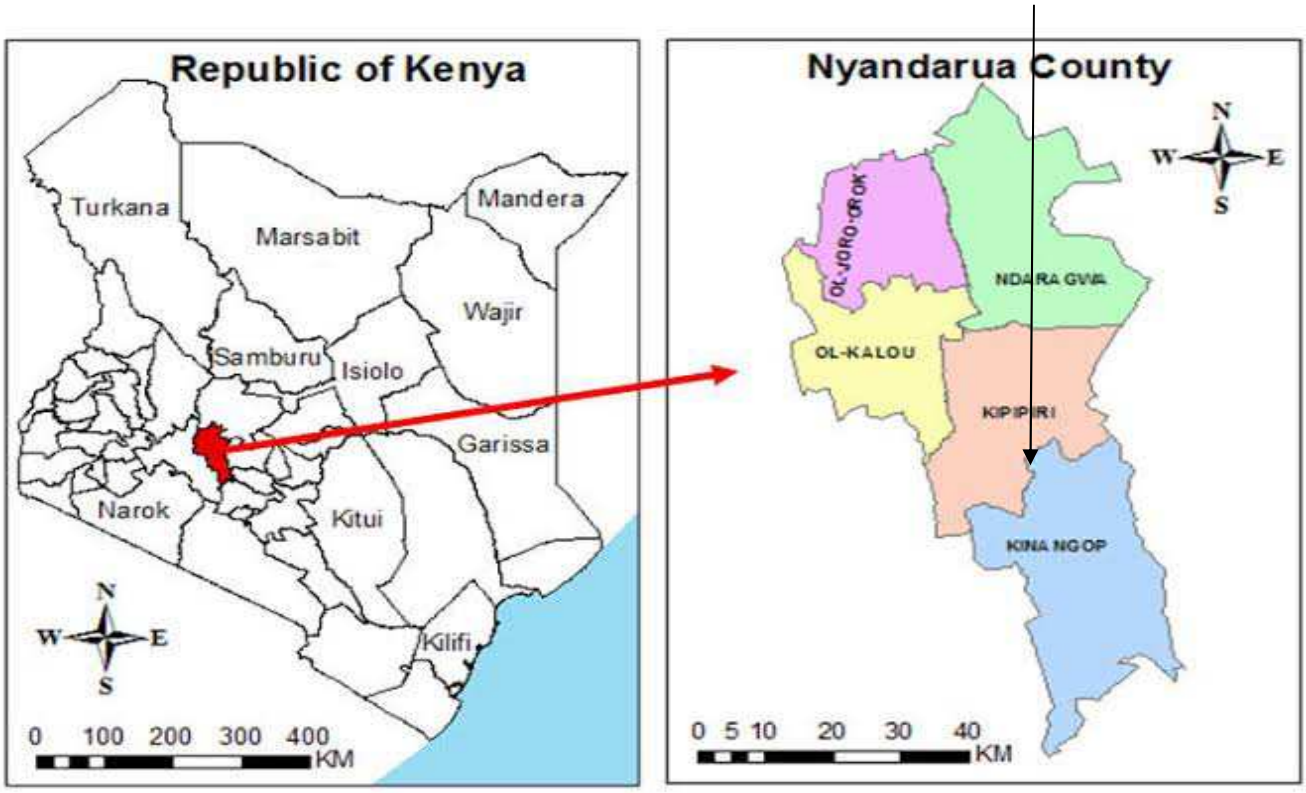

Figure 1. *Map of Kenya locating Nyandarua County and Kinangop Sub County.*

3.2. Research Design

The study employed descriptive survey research design since it enabled the researcher to present variables under investigation and their effect with respect to marketing channel choices. Structured questionnaires facilitated collection of cross-sectional data obtained from the selected sample. Analytical techniques such as one-way anova, t-test, chi square test, frequency tabulations and multinomial logistic (MNL) regression model were employed in data analysis.

3.3. Sample Size Determination

The formula by [31] was used to determine the sample size. Mathematically, the formula was stated as: $n = \frac{NC^2}{C^2+(N-1)e^2}$ Where: n = sample size, N = Study population, C = Coefficient of variation and e is the error term. Therefore the sample size corresponding to N = 35840 was 230.

3.4. Sampling Procedure

Both stratified and simple random sampling techniques were used to sample smallholder dairy farmers in the study area. Stratified sampling involved using the sample frame to classify smallholder dairy farmers based on their respective wards. Afterwards, 230 farmers were randomly selected in Engineer (30), Njabini (25), Magumu (14), Nyakeo (35), Murungaru (39), Gedhabai (27), Gadhara (28) and North Kinangop ward (32) using proportionate sampling technique.

3.5. Data Analysis

The study used single cross-sectional data obtained from 230 randomly selected dairy farmers using structured questionnaires. Data on socio-economic characteristics was analysed on the basis of marketing channels using anova and chi square tests.

Similarly, a multinomial regession regression was run to ascertain the relationship between a vector of determinant factors and marketing channel choices in the study area. Analysis was performed using STATA and Microsoft Excel computer programs.

3.6. Empirical Model

The study employed the multinomial logit model to analyse the determinants of milk marketing channel choice in the study area. The model is used to predict a nominal dependent variable given one or more independent variables and it allows for analysis of decisions with more than two choice categories in the dependent variable. The model is suitable when the outcomes are mutually exclusive and collectively exhaustible [17] hence making it possible to determine choice probabilities for different marketing channel options. A multinomial logit model was specified to show the relationship between the odds of selecting the j^{th} marketing channel relative to a vector of

explanatory variables as illustrated bellow.

$$prob_{ij} = \frac{e^{\beta_{ij}X_i}}{\sum_{j=0}^{j} e^{\beta_{ij}X_i}}, j = 1,2,3 \quad (2)$$

The probability of selecting the base outcome is specified as:

$$prob\ (j = 1|x_i) = \frac{1}{1+\sum_{j=1}^{3} e^{\beta_{ij}X_i}} \quad (3)$$

The probability of smallholder dairy farmer selecting either of the two marketing channels (j = 2 or 3) is estimated as given in equation (4)

$$prob\ (j = m|x_i) = \frac{e^{\beta_{ij}X_i}}{1+\sum_{j=2}^{3} e^{\beta_{ij}X_i}}\ for\ m > 1 \quad (4)$$

The coefficients of the multinomial logit model only give the direction of the relationship between the dependent and explanatory variables hence the estimates cannot be interpreted in terms of probabilities or odds ratio, the marginal effects provide a means of measuring how a unit change in the explanatory variables from their means influence the probability of selecting a particular marketing channel [19]. The odds ratios measure how a unit change in the explanatory variables influence the odds of selecting a particular marketing channel. The log odds were specified as:

$$\ln(\frac{P_{ij}}{Pi}) = x'_i\left(\beta_j - \bar{\beta}\right) = x'_i\beta_j, \text{if k} = 0 \quad (5)$$

The model was explicitly stated as:

$$y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \beta_{16} X_{16} + \beta_{17} X_{17} + \varepsilon \quad (6)$$

The variables, coding system, categories and sign expectations are as outlined in table 1. From the table, seventeen variables were coded as either dummy or continuous and hypothesized to be having a positive, negative or either positive or negative relationship with the dependent variables relative to the reference category (milk processors).

Table 1. *Independent variables used in the multinomial logistic regression model.*

Variable	Coding System	Category	Sign
Dependent variables			
Milk processors	Reference category	Y = 1	
Milk bars		Y = 2	
Directly to consumers		Y = 3	
Independent variables			
X_1 = Gender	1 if male, 0 if female	Dummy	+/-
X_2 = Marital status	1 if married, 0 if otherwise	Dummy	+/-
X_3 = Formal schooling	1 if attained, 0 if otherwise	Dummy	+/-
X_4 = Household head	1 if head, 0 if otherwise	Dummy	+/-
X_5 = Family size	Number of members	Continuous	+/-
X_6 = Credit access	1 if credit user, 0 if otherwise	Dummy	-
X_7 = On farm income	Kenyan shillings	Continuous	+/-
X_8 = Off farm income	Kenyan shillings	Continuous	-
X_9 = Ownership	1 if sole trader, 0 if Partnership	Dummy	+
X_{10} = Transport cost	1 if high, 0 if otherwise.	Dummy	+
X_{11} = Extension access	1 if yes, otherwise 0	Dummy	+/-
X_{12}= Farming experience	Number of years	Continuous	-
X_{13}=Association member	1 if yes, 0 if otherwise	Dummy	+/-
X_{14} = Milk storage	1 if own, otherwise 0	Dummy	+/-
X_{15} = Mode of payment	1 if convenient, otherwise 0	Dummy	+
X_{16} = Transport means	1 if own, otherwise 0	Dummy	+
X_{17} = Market information	1 if own, otherwise 0	Dummy	+

4. Results and Discussions

4.1. Distribution of Marketing Channel Choices

The study identified three major marketing channels as illustrated in figure 2. Milk processors were highly preferred (46.09) % due to surety of payment and loan facilities offered to farmers. Second in preference was milk bars (32.61) % and direct sale (21.3) %. Respondents cited better milk prices and timely processing of payment as their main choice drivers. Milk bars and direct sale options were however unable to absorb increased volumes of milk hence unsuitable for farmers with more lactating cows.

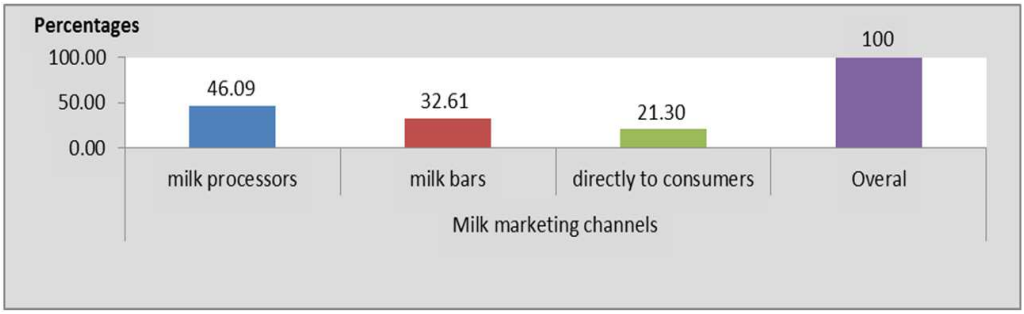

Figure 2. *Milk marketing channels in Kinangop Sub County.*

4.2. Socio-economic Profiles and Milk Marketing Channels

More males (59.67) % were market participants relative to their female counterparts (40.43) % implying that males are more connected within the marketing system besides being risk takers. Similarly, more males (90) % attained formal schooling relative to females (10) %, formal schooling attainment attracted market participation as opposed to non – formal schooling (Table 2). This could be attributed to the fact that formal schooling enhances information seeking behaviour of farmers making them to be aggressive in terms of market search.

Generally, majority (50) % of respondents derived their livelihoods directly from dairy farming, (15.65) % were formally employed, (21.74) % engaged primarily in mixed farming while (12.61) % were in the informal sector. Additionally, market participation was higher for farmers who primarily engaged in dairy farming than for farmers primarily engaged in other occupations since they had more time hence could put in more effort in market search (Table 2). Majority of the respondents were credit non-users (65.65) %, only (34.45) % were credit users, an implication of limited access to credit (Table 2). Generally, a greater portion (55.22) % of farmers never owned a means of transport, majority being farmers who engaged in direct sales (77.55) %. This could be as a result of reduced proximities between the buyers and sellers hence. Farmers could easily supply milk to the nearby villages or sell at the farm gate. Only (44.78) % of farmers owned transport means majority being farmers who preferred milk processors (70.75) %. This was to facilitate delivery of milk to collection points as stated by the respondents. In general, only (46.52) % of farmers had knowledge about the market a greater portion being farmers who engaged in direct sales (63.27) % (Table 2). While majority (53.48) % had no information about the market hence a greater portion of farmers in the study area were underprivileged in terms of information access which could have consequently led to inefficient use of different marketing channels thereby impeding their efforts towards maximization of returns.

Table 2. *Respondents' socio-economic profiles and milk marketing channels.*

Variable	Categorical	Milk marketing channels			Overall
		Milk processors	Milk bars	Directly to Consumers	
Gender	Male	67 (63.21)	44 (58.67)	26 (53.06)	137 (59.67)
	Female	39 (36.79)	31 (41.33)	23 (46.94)	93 (40.43)
Formal schooling	Yes	97 (91.51)	70 (93.33)	40 (81.63)	207 (90)
	No	9 (8.49)	5 (6.67)	9 (18.37)	23 (10)
Main livelihood source	Formal	14 (13.21)	12 (16)	10 (20.41)	36 (15.65)
	Informal	17 (16.04)	5 (6.67)	7 (14.29)	29 (12.61)
	Dairy	57 (53.77)	37 (49.33)	21 (42.86)	115 (50)
	Mixed farming	18 (16.98)	21 (28)	11 (22.45)	50 (21.74)
Credit access	Yes	46 (43.40)	22 (29.13)	11 (22.45)	79 (34.45)
	No	60 (56.6)	53 (70.67)	38 (77.55)	151 (65.65)
Transport ownership	Yes	75 (70.75)	17 (22.67)	11 (22.45)	103 (44.78)
	Otherwise	31 (29.25)	58 (77.33)	38 (77.55)	127 (55.22)
Market information	Yes	49 (46.23)	27 (36)	31 (63.27)	107 (46.52)
	No	57 (53.77)	48 (64)	18 (36.73)	123 (53.48)

Percentages in parenthesis.

4.3. Socio-economic and Channel Characteristics

A one-way ANOVA was conducted to determine the relationship between socio-economic characteristics and marketing channel choices. Years of schooling ($p \leq 0.1$), on-farm income ($p \leq 0.1$) and milk output ($p \leq 0.01$) were statistically significantly different across the three marketing channels. Years of schooling and on-farm income were significantly higher for farmers who preferred milk processors relative to farmers who preferred direct sale option ($p \leq 0.1$). This could be explained by the fact that milk processors provide extension and other support

services such as credit to farmers which could have ultimately enhanced their production capacity thereby translating to more income. Moreover, milk production was significantly higher for farmers who used milk processors as opposed to farmers who pursued other milk marketing outlets ($p \leq 0.01$).

Table 3. *Summary statistics for socio-economic characteristics and marketing channels.*

Variable	Milk marketing channels			Pooled	F-Statistic	p-value
	Milk processors (N = 106)	Milk bars (N = 75)	Consumers (N = 49)			
Age of farmer	39.9	38.4	39.8	39.4	0.76	0.4697
Years of Schooling	8	7.9	6.4	7.6	2.74	0.0669*
Off-farm income	12866.9	11997.3	13008.2	12613.5	0.13	0.8741
On-farm income	19266.9	16272.6	13013.3	16958.3	2.84	0.0607*
Farming experience	10.8	11.5	12.3	11.4	1.89	0.1539
Farm gate price	32.38	32.59	33.14	32.61	0.98	0.3757
Milk production	482.04	393.46	238.96	341.13	36.77	0.0000***

***, **, *: significant at 1%, 5%, and 10% respectively.

4.4. Empirical Results

i. Marital status

Marital status was significant with a negative coefficient. The odds ratio indicates that *ceteris peribus,* married farmers have a low preference for direct sales relative to milk processors. This could be explained by the fact that milk processors guarantee payment to farmers due to formal agreement between them. Similarly, cooperatives offer formal credit to farmers and since married farmers have more financial needs, they are more likely to prefer a marketing outlet that guarantees stable returns. These findings are in conformity with the findings of [33] which revealed marital status to be significant in explaining marketing channel choices among maize and sunflower farmers.

ii. Extension Access

Access to extension services significantly influenced marketing channel choices at ($p \leq 0.05$). The negative coefficient and the odds ratios imply that farmers `who accessed extension services were less likely to pursue milk bars and direct sale options relative to milk processors *ceteris peribus*. This could be explained by the fact that through extension and outreach programs, farmers could have been trained on the benefits of pursuing milk processors as a marketing outlet relative to other potential outlets. [34, 29] also presented similar findings. Tawanda et al. [37], in their study found extension access to have a significant influence on the likelihood of participating in cattle markets.

iii. Association Membership

Association membership was significant ($p \leq 0.05$). The positive coefficient and the odds ratio imply that *ceteris peribus,* association members' preferred milk bars and direct sale options relative to milk processors. These findings corroborate the findings of [34]. Members of farmer based association have the advantage of networking and therefore considered to be having more market information. As such they are likely to pursue other marketing outlets with the aim of enhancing income returns.

iv. Mode of Payment

Mode of payment was significant ($p \leq 0.01$) with positive coefficients, an indication that farmers would shift their preference for other milk marketing outlets whenever payment is delayed by milk processors.

v. Transport Ownership

The coefficient for transport ownership was negative and significantly related to marketing channel choices at ($p \leq 0.05$). The odds ratio indicates that *ceteris peribus,* owning a means of transport reduces the preference for milk bars and directly to consumers relative to milk processors. This could be attributed to the fact that transport ownership facilitates milk delivery to milk collection points since members of cooperatives produced more milk than their other counterparts.

Table 4. *Multinomial logistic regression model results.*

Variable	Coef.	Milk bars		p- value	Odds ratio	Variable	Coef.	Direct sales		p-value	Odds ratio
		Std. Error	z					Std. error	z		
Gender	0.2015	0.7867	0.26	0.798	1.22	Gender	-0.5172	0.7829	-2.05	0.509	0.60
Marital status	-0.6888	0.4453	-1.55	0.122	0.50	Marital status	-0.8622	0.4452	-1.73	0.053*	0.42
Formal schooling	1.0040	1.0086	1.00	0.320	2.73	Formal schooling	-0.6321	0.8804	-2.36	0.473	0.53
Household head	-0.9232	0.8127	-1.14	0.256	0.40	Household head	-0.7512	0.8051	-2.33	0.351	0.47
Family size	-0.0879	0.1292	-0.68	0.496	0.92	Family size	-0.0420	0.1275	-0.29	0.742	0.96
Credit access	0.6206	1.1686	0.53	0.595	1.86	Credit access	0.2826	1.1963	-2.06	0.813	1.33
On farm income	-0.0135	0.9392	-0.01	0.989	0.99	On farm income	0.0940	0.9199	-1.71	0.919	1.10
Off farm income	-0.0442	0.3599	-0.12	0.902	0.96	Off farm income	0.4446	0.3569	-0.25	0.213	1.56
Ownership	2.0019	1.4998	1.33	0.182	7.40	Ownership	0.6958	1.3871	-2.02	0.616	2.01
Transport cost	-0.0002	0.0003	-0.67	0.502	1.00	Transport cost	-0.0003	0.0003	0.00	0.288	1.00
Extension access	-2.0293	0.8558	-2.37	0.018**	0.13	Extension access	-1.8930	0.8736	-3.61	0.03**	0.15
Farming Experience	-0.0457	0.0713	-0.64	0.522	0.96	Farming Experience	0.0763	0.0765	-0.07	0.319	1.08

Variable	Coef.	Milk bars		p- value	Odds ratio	Variable	Coef.	Direct sales		p-value	Odds ratio
		Std. Error	z					Std. error	z		
Association member	2.3784	0.9869	2.41	0.016**	10.79	Association member	2.0007	1.0137	0.01	0.048**	7.39
Milk storage facilities	-1.9264	1.5013	-1.28	0.199	0.15	Milk storage	-0.0245	1.2729	-2.52	0.985	0.98
Mode of payment	6.2363	0.8969	6.95	0.000***	510.96	Mode of payment	5.3400	0.8695	3.64	0.000***	208.51
Transport Ownership	-1.5570	0.6473	-2.41	0.016**	0.21	Transport Ownership	-1.5765	0.6417	-2.83	0.014**	0.21
Market information	-0.9259	0.6379	-1.45	0.1470	0.40	Market information	0.7404	0.6217	-0.48	0.234	2.10
_cons	-0.6157	8.7479	-0.07	0.9440	0.54	_cons	-4.5040	8.5000	-21.16	0.596	0.01
Observations	=	230									
Model diagnostics											
LR chi2 (34)	=	240									
Prob > chi2	=	0.0000									
Log likelihood	=	-121.145									
Pseudo R2	=	0.4976									
Base category	milk processors										

***, **,*: Significant at 1, 5, 10% respectively.

5. Conclusion and Recommendations

From the study, dairy farming is the main source of livelihood among smallholder farmers in the study area. Majority of farmers having limited market information. Milk production was generally low. From the empirical results, marital status, extension access, association membership, owning a means of transport and mode of payment were significant in explaining preferences for milk bars and consumers relative to milk processors. The study therefore recommended policies geared towards enhancing more years of formal education and market intelligence so as to facilitate selection of efficient markets, more training on dairy husbandry practices with the aim of increasing milk output, facilitate access to transport facilities so as to enhance delivery of milk to milk different collection points as well as to facilitate access to other markets. The study also recommended a review of payment arrangements between milk processors and farmers so as to avoid the problem of delayed payments to farmers.

Conflicts of Interest

The authors declare that they have no competing interests.

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