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Factors influencing choice of milk market outlets among smallholder dairy farmers in Kuresoi north sub-county, Kenya

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Kuresoi North Sub-County has experienced a rapid expansion in milk production and there exist both formal and informal milk market outlets. With these abundant opportunities, much of the produced quantities of milk are expected to enter the market and farmers' livelihoods be improved. However, it is not clear whether the smallholder milk producers are exploiting the existing and emerging market opportunities through the choice of market outlets. The objective of this study was to identify factors influencing choice of milk market outlets among small holder dairy farmers in Kuresoi North sub-county. A total of 196 respondents were selected using multistage sampling and a semi-structured and pre-tested questionnaire was used to collect data. SPSS and STATA were used to analyze the data. Results showed that occupation of the household, group marketing, access to credit, distance to market point, number of cows, milk volume, price of milk and type of breed significantly influenced the choice of milk marketing outlets. The study recommends that the county government in collaboration with other stakeholders in the milk sector should increase marketing information and capacity building by promoting expansion of dairy farming and linking the farmers to alternative markets thus improving their welfare.

Key words: Smallholder milk producers, market outlet, choice of market outlet.

INTRODUCTION

Dairy farming is one of the key economic activities practiced in most parts of developing countries. It is one of the income generating activities that contributes to the alleviation of poverty by ensuring that farmers get regular cash flows as opposed to other intermittent incomes such as crop cultivation and other forms of livestock keeping, like bee, poultry, sheep and pigs (FAO, 2014). In Kenya, dairy farming subsector contributes about 4% of the country's Gross Domestic Product (GDP) and approximately 14% of total agricultural products output (KNBS, 2010). About 70% of the dairy farmers in Kenya are smallholders, many of whom are situated in the Rift Valley and Central regions (Smallholder Dairy Project, 2008). This subsector also contributes a highly significant share of food for the majority of the Kenyan population as well as providing a direct livelihood opportunity to more

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than 650,000 smallholder farmers.

The dairy sector in Kenya recorded significant growth between 2005 and 2012, as evident from the increases of recorded milk production from 2.650 to 3.733 billion litres, dairy herd size growth from 3.5 to 4.2 million and per capita per cow milk output increase from 757 to 898 L over the same period (GoK, 2013; FAO, 2014). Kenya is currently the leading milk producer in the East African countries and the demand for milk by its consumers is estimated to be growing at 3.6% per year (FAO, 2014). The increase in milk production which has led to surplus and unprocessed milk with the concurrent increase in the volume of imported skimmed milk may be attributed to lack of appropriate or weak marketing outlets and inefficiency of processing plants, which hardly utilize the 50% of the installed annual processing capacity of 985 million litres in Kenya (KDB, 2014). This leads to increased demand for milk in urban areas that may influence dairy farming and market outlets (Swain and Teufel, 2017). According to Wanjala et al. (2015) majority of farmers are taking dairy farming as a business with the aim of maximizing profits but produce for unidentified markets. This exposes them to market and price shocks. There exist both formal and informal milk market outlets in Kuresoi North Sub-County and the area has experienced a rapid expansion in milk production. The aim of the majority of farmers is to increase income from milk by exploiting the existing markets. This is possible given abundant market opportunities. However, it is not clear whether these smallholder milk producers are exploiting the existing and emerging market opportunities hence the necessity to analyze the determinants of choice of market outlets by smallholder dairy farmers in the Sub-County.

MATERIALS AND METHODS

Study area

This study was carried out in Kuresoi North Sub County, one of the nine sub counties in Nakuru County. The Sub County occupies a total area of 559.70 km^2 and has a population of 124,050 people (KNBS, 2010). Administratively, the sub county has four wards: Kiptororo, Nyota, Sirikwa and Kamara. Temperatures in the subcounty range from a high of 29.3°C between the months of December, January, February, and part of early March to low temperatures of up to 20°C during the month of June and July. The area receives rainfall of between 950 and 1500 mm per annum and covers areas with an altitude of between 900-1800 m above sea level. Farmers in this area practiced potato growing; dairy farming; commercial businesses and other agricultural products that include; maize, beans, vegetables, coffee, and tea. The county has a bimodal rainfall pattern where short rains fall between October and December while the long rains fall between March and May (NCIDP, 2013)

Sampling procedure and Sample size determination

Multi-stage sampling was applied to select the respondents. Purposive sampling was first used to select Kuresoi North sub-county because dairying is a major economic activity for majority of the people in the sub-county. In the second stage, the 4 wards (Kiptororo, Nyota, Sirikwa and Kamara) were also purposively selected because they are the leading milk producing areas in the sub-county. Lastly, random sampling of smallholder farmers was done in the wards. The formula by Anderson et al. (2007) was used to determine the sample size at 95% confidence level with a z-value of 1.96. The margin of error was 7%. Therefore the estimated sample was determined using the following formula;

$$n = \frac{pqz^2}{E^2}$$

Where, n = sample size, p = proportion of the population containing the major interest, q = 1-p, z= confidence level (α = 0.05), E = acceptable/allowable error. Since the proportion of the population is not known, p=0.5, q = 1-0.5= 0.5, Z = 1.96 and E = 0.07, then $n = \frac{0.5\times0.5\times(1.96)^2}{(0.07)^2} = 196$ respondents.

Since the proportion of the smallholder dairy farmers was not known, an equal number of 49 respondents were selected in each wards.

Theoretical framework

Farmer's choice decision of milk marketing outlet in an expected utility framework that is based on random utility theory (Greene, 2000). This framework assumes that different farmers assess their expected utilities for their own marketing outlet. The farmer then examines his or her net return distribution by considering the certainty equivalent for each marketing outlet by calculating associated costs incurred. The cost is the amount that would make the farmer indifferent to deliver to a given outlet. Since smallholder dairy farmer's choice to sell milk to one outlet and leaving the others is viewed as a multi-choice problem, the decision to sell to informal, formal or both formal and informal (pooled) depends on the maximum utility or net returns derived from that outlet. This theory was identified as appropriate under the assumption that household i is faced with more than two options (Greene, 2000; Gujarati, 2007). A household i faced with a decision to choose from among the different alternatives therefore is perceived to attain a certain level of utility from each alternative based on their characterization as represented in the Equation 1.

$$U_{ij} = \beta \mathrm{F_{ij}} + \varepsilon_{ij} \quad (1)$$

Where; U_{ij} is the maximum utility that an individual i derive from choosing $j\,th$ marketing outlet, $\mathrm{F_{ij}}$ is a vector of individual characteristics, β is the parameter to be estimated and $\varepsilon\, i\, j$ – is the error term.

Since individual`s utility cannot be observed, but we can observe some of the attributes of the marketing outlet chosen by the decision maker and/or individual's characteristics such as household and personal characteristics, the utility therefore can be decomposed into deterministic (W_{ij}) and random (ε_{ij}) parts as given in Equation 2.

$$U_{ij} = W_{ij} + \varepsilon_{ij} \quad (2)$$

Where U_{ij} is the channel choice, W_{ij} is the indirect utility and ε_{ij} is the random error term. The choice strategy is given by probability of choosing one outlet and leaving the others or also chosing to sell to both outlet.

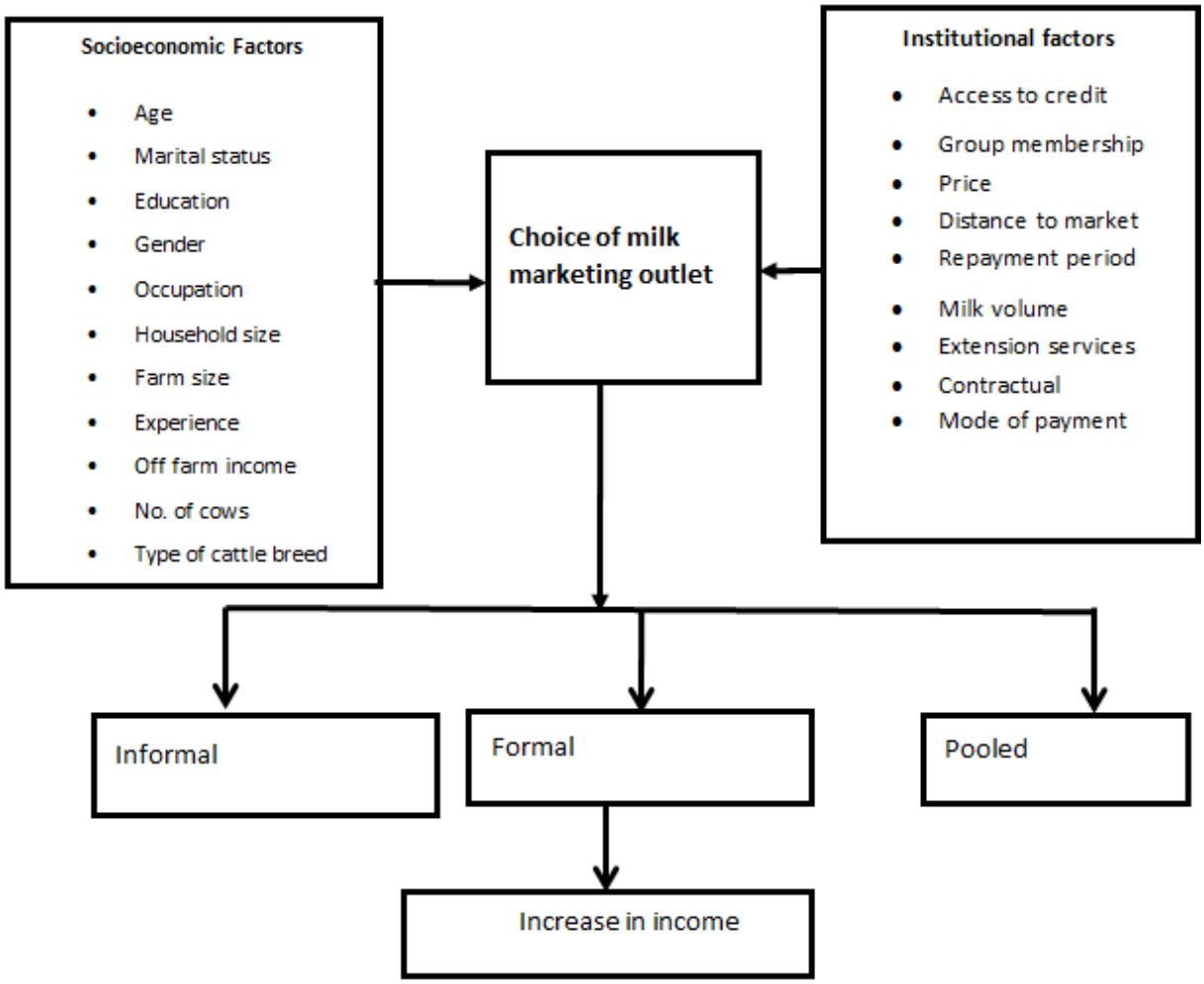

Figure 1. Conceptual framework.
Source: Author

Conceptual framework

The conceptual framework in Figure 1 depicts that dairy farmers' choice of a milk market outlet is assumed to be influenced by socio-economic characteristics of the farmer such as age, marital status, gender, experience, household size, farm size, off-farm activities and education level. It is also assumed to be influenced by the background factors that include institutional factors such as; access to credit, prices, group membership, repayment period, distance to market and milk volume. These factors when they interact together influence the farmers to choose a marketing outlet. The chosen outlet therefore is perceived to increase income, thus improving the livelihood of smallholder milk producer.

Econometric models of analysis

To analyze the factors influencing dairy farmer's choice of milk market outlet, multinomial logit model was employed. Multinomial logit can be derived from the assumption of random utility model of utility maximization which assumes that if an individual i makes a choice j from a complete list of channel bundle then the utility of that particular channel is maximum (McFadden, 1976; Green 2003). Smallholder dairy farmer sold milk to either formal or informal or both. The utility associated with the three outlets was denoted by; Z^{F}_{io}, Z^{I}_{io} and Z^{FI}_{io}, respectively. The utility levels in a marketing outlet are a function of personal characteristics and household composition. In this case, a dairy farmer was assumed to make choice decision among the three outlets, he can also be delivering to more than one outlet and therefore to determine factors that influence this decision, the use of random effects to model the dependence across sequential decisions was necessary.

The choice variable (dependent variable) has more than two unordered options in this case. The outlet independent variables can consist of features/attributes of the alternatives and characteristics of the respondent such as, age, marital status, off-farm income, education. McFadden (1976) first introduced the multinomial logit model (MNL) to explain the choice of transportation modes of urban commuters with the random utility model. The multinomial logit model continues to be a popular choice model because choice probabilities formula has a closed form and is readily and easy interpretable. Multinomial logit model was preferred in the study since it permits the analysis of decision across more than two categories in the dependent variable hence making it possible to determine choice probabilities of different milk market outlets. Furthermore, MNL is simpler to compute compared to multinomial probit which poses a challenge in computing multivariate normal probabilities for any dimensionality (Greene,

Table 1. Marginal effect from Multinomial Logit on the choice of milk marketing outlets.

Variable	Informal			Formal			Pooled		
	dx/dy	SE	P>|z|	dx/dy	SE	P>|z|	dx/dy	SE	P>|z|
Gend	0.024	0.075	0.751	-0.050	0.082	0.537	-0.009	0.061	0.882
Occup	-0.110	0.069	0.107	0.117**	0.062	0.060	0.020	0.052	0.697
Age	0.032	0.003	0.992	0.004	0.004	0.264	-0.003	0.003	0.285
Mrts	0.045	0.091	0.618	0.041	0.081	0.611	-0.056	0.085	0.505
Hsize	0.018**	0.019	0.353	-0.030*	0.021	0.139	-0.002	0.015	0.872
Educ	0.016	0.043	0.709	-0.009	0.045	0.843	-0.017	0.036	0.639
Slnd	-0.023	0.023	0.333	0.011	0.020	0.591	0.006	0.017	0.735
Ncow	-0.091**	0.038	0.016	0.073*	0.040	0.069	0.045	0.027	0.103
Brd	0.061*	0.035	0.080	-0.061	0.037	0.102	-0.003	0.027	0.904
Milkvol	-0.011*	0.007	0.099	0.014**	0.006	0.018	0.003	0.004	0.475
Prclit	0 .157	0.004	0.689	0.013***	0.005	0.006	0.008**	0.003	0.014
Pinf	-0.069	0.072	0.333	0.059	0.077	0.443	0.007	0.061	0.908
Expe	0.003	0.011	0.981	-0.011	0.011	0.358	0.009	0.007	0.192
oyfm	-0.126**	0.089	0.052	0.178**	0.0803	0.027	0.0310	0.0652	0.634
Neighef	-0.078	0.070	0.268	0.025	0.078	0.751	0.100*	0.059	0.089
Contr	0.062	0.069	0.373	0.066	0.076	0.379	-0.003	0.052	0.950
Dist	0.064***	0.022	0.003	0.047**	0.022	0.030	0.038**	0.016	0.020
Grp	-0.064**	0.080	0.070	0.029**	0.075	0.069	0.119**	0.076	0.012
Crdtt	-0.293**	0.122	0.016	0.095	0.105	0.365	0.153	0.111	0.169
Extns	-0.391	0.084	0.242	0.104	0.092	0.261	-0.005	0.055	0.935

LR chi2(40) = 107.93 Prob > chi2 = 0.0000 Log likelihood = -109.73115, Pseudo R = 0.3297.
*, **, ***: significance at 10, 5 and 1% level respectively.
Source: Author

2000).

Assume the utility of household *i* choosing market outlet *j* is given by U_{ij} is a linear stochastic function of exogenous household characteristics X and endogenous household choices Z:

$$U_{ij} = \alpha X + \beta_Z + \varepsilon$$

The parameter estimates of the MNL model only provide the direction of the effect of the independent characteristic variables on the dependent (choice) variables; thus the estimates represent neither the actual magnitude of change nor the probabilities. Marginal effects are then computed and are used to measure the expected change in probability of a particular marketing outlet choice being chosen with respect to a unit change in an independent variable from the mean (Greene, 2000). The following model was specified for market channel choice analysis; Where $Y_{ij} =$ choice is the dairy market outlet used by the farmer (informal market, formal market and both formal and informal market), while β are coefficients associated with each explanatory variable and the ε is the error term. Several factors were hypothesized to influence the farmers' choice of milk market outlet. The choice of these explanatory variables was mainly based on the general working hypothesis and partly on empirical findings from literature, and therefore, a positive or negative sign was assigned depending on the potential influence of a particular variable on choice of market outlet. The implicit function form therefore was given as:

$$Y_{ij} = \alpha + \beta 1\, Age + \beta 2\, Gend + \beta 3\, Mrts + \beta 4\, Educ + \beta 5\, Hsize + \beta 6 Slnd + \beta\, 7 Exts + \beta 8\, Crdt + \beta 9\, Yfm + \beta 10\, Occup + \beta 11\, Dist + \beta 12\, Mpay + \beta 13\, Neigh + \beta 14\, Plt + \beta 15\, Contr + \beta 16\, Expe + \beta 17\, Pinf + \beta 18\, Exp + \beta 19\, N\, cow + \beta 20\, Brd + \beta\varepsilon$$

Where Y_{ij}^{*} is the marketing outlet choice
α – Constant,
β 1,2,3 ……17 –Factors to be determined
ε-Error term

RESULTS AND DISCUSSION

Table 1 presents the results of the Multinomial Logit model. The Chi-square value of -109.73 showed that likelihood ratio statistics are highly significant (P < 0.000) suggesting that the model had strong explanatory power. The pseudo-R square was 0.3297 indicating the explanatory variable explained about 32.97% of the variable in the choice of milk market outlets. Before the marginal effects were run, the likelihood coefficients were estimated to provide the direction of the effect of the independent variable on the dependent variables. The marginal effects from the Multinomial Logit model measure the magnitude of change in the probability of a particular choice of market outlet being made with respect to a unit change in an independent variable. The significant variable values also known as the p-values shows whether a change in the independent variable significantly influences the Logit at a given level (Gujarati, 2007).

Occupation of the household head was positive and significant among smallholder dairy farmers who sell their milk to formal markets at 5% significant level. The result indicated that the farmers who are employed or have other business apart from their dairy activities are 11.7% likely to sell their milk to formal markets than the informal or both. This result was expected because of the fact that farmers who have other occupations may prefer formal markets which make payments through banks compared to cash transactions in the informal outlets.

The size of the households positively influenced the choice of informal market at 5% significant level (ME=0.018). An increase by one adult increases the likelihood of selling milk to informal market by 1.8% and a reduction of 3% ($p<0.05$) in the use of formal outlet. The nutritional requirements of the household takes precedence leading to a reduction in milk sold to formal markets and only a small quantity for informal outlets. This result is in conformity with Staal et al. (2006) who established that the higher the number of adults in a household, the more likely the household is to sell milk through the private trader channels and cooperative processors channel than the individual customer channels. This finding was also in line with Justus et al. (2018) in their study of Determinants of Households' Market Participation around Community Milk Cooling Plants, Western Kenya who explained that, the larger the household size, the more volume of milk required for domestic consumption and the lesser amounts availed for markets. There was a negative relationship between the number of cows a household head owned and the choice of informal outlet at 5 percent significance level. A unit increase in the number of milking cows owned reduced the probability of using informal outlet by 9.1% (ME= 0.091) but increased the probability of using formal outlets by 7.3%. This is because of anticipated increase in quantity of milk produced necessitating a shift from informal to formal channels. These results are contrary to Vijay et al. (2009) who noted that there is a negative relationship between herd size and choice of cooperative marketing channel among dairy producers.

There was a positive relationship between the type of breed a household head owned and the choice of informal outlet at 10% significance level. A change in the type of breed owned increases the probability of using informal outlet by 6.1% (ME= 0.061). This is plausible since most of the smallholder dairy farmers kept the indigenous zebu cows which do not produce adequate milk to support sales. However, one additional head of exotic breeds initiates marketing tendencies towards informal outlets due to surplus milk.

Milk volume variable showed a negative relationship in choice of informal outlet and significant ($p<0.1$). An increase in total milk produced by one unit reduces the probability of that household selling its milk through informal outlet by 1.1% and increases the use of formal outlet by 1.4%. This plausible since formal markets buy milk in bulk compared to small traders who buy at farm gate in small quantities. The implication is that farmers who produce large volume of milk prefer selling to the outlet which is capable of absorbing all amounts of milk. Dairy farmers who produce small amounts of milk could reasonably sell at farm gate to avoid transport costs. These results are consistent with Tsourgiannis et al. (2005) who reported a positively relationship between volume of milk produced by the farmer per day and choice of cooperatives marketing channel.

Price of milk per litre was positive and significant among the farmers selling their milk to formal market as well as both formal and informal outlets (pooled). The results showed that smallholder dairy farmers were indifferent to the market outlet in relation to the price per litre. However, 1.3% were likely to sell milk to formal market compared to 0.8% who could sell to either formal or informal outlets. This means that the price offered by the formal channels induces the farmers to sell through this outlet. Artukoglu and Olgun. (2008) Tsourgiannis et al. (2005) noted that the choice of the marketing outlet by dairy farmers heavily depended on the price offered by that outlet. Marketing outlets that offered price premiums to farmers received large volume of milk compared to those outlets which were offering low prices.

Neighborhood effect was significant ($p<0.1$) and increased the probability of farmers selling their milk to both formal and informal outlets by 10%. This can be explained by the fact that farmers inquire information on market condition and the prices amongst themselves and will tend to sell their milk depending on their priorities. For instance a farmer with urgent needs for money will sell to informal outlets and *vice versa*. The findings conforms the sudy by Mutura et al. (2015) who stated that turnover and volume of milk produced contribute to the probability of a household integrating vertically and horizontally integrated farmers who were willing to pay more for market information had higher monthly gains.

Off farm income was negative and significant at 10% significance level. Working off farm and having dairy farming enterprises had a negative effect on in the informal market and reduces the probability of selling informal market by 12.6% (ME= -0.126). It, however, increased the probability of using formal outlets by 17.8% ($p<0.05$). The results imply that, farmers who had off farm income generating activities were less likely to sell to informal markets. This is because they may not be in urgent need of cash offered at the farm gate. Formal markets offers them a less hectic alternative where payments are made directly into bank accounts on a monthly basis. According to Omiti et al. (2009), non-farm income contributes to more marketed output if the non-farm income is invested in farm technology and other farm improvements. Otherwise, marketed farm output reduces if off farm income triggers the diversification.

The distance to milk marketing outlet point significantly determined the probability of farmers choosing the

market outlet (p<0.01). It had a negative effect on informal marketer (ME= -0. 064) this means that as the distance to the market increases by 1 kilometer, the likelihood of selling to informal market decreased by 6.4% and selling to formal markets increased by 4.7% (p<0.05). Longer distances increase the transaction costs of small buyers who must move around hawking in different places and the only option is to sell to formal markets which involves supplying milk to designated collection points. This finding coincides with Apind et al. (2015) who stated that as the distance increases, the probability of farmers selling to private millers increases compared to other outlets. It also in contrast with the findings of Wanjiru et al. (2012) who stated that an increase in distance to the market increases the probability of selling to the local traders and brokers in the case of banana marketing.

Group marketing negatively influenced choice of informal market (p<0.05) (ME = -0.064). Farmers are 6.4% less likely to sell their milk to informal outlets and 2.9% (p<0.05) more likely to sell to formal outlets when they are in groups. This is plausible because groups are formally organized for collective action in marketing. In essence, membership to a group increases access to information which is important to production and marketing decisions. Most farmer groups engage in group marketing, bulk purchasing of milk and credit provision for its members prefer the formal markets (Olwande and Mathenge 2012). Njuki et al. (2009) found that besides reducing transaction costs, group marketing helps in empowering farmers to negotiate for better prices in the market and trading terms markets. Farmers in groups have high bargaining power as well as informed prices on their production therefore increasing the probability of selling to formal markets.

On the other hand, group membership positively influenced participation in both formal and informal markets (p<0.05). Pooled results suggest that there is 11.9% chance of selling to both formal an informal outlets while in a group. This is because being a member of a group does not dictate farmers the quantities to supply. They still have a choice to decide on the quantities to sell to either formal or informal outlets. This finding coincides with Mutura et al. (2015) who stated that group membership increases the probability of farmers selling to formal milk outlets compared to other outlets.

Access to credit was negative and highly significant (p<0.05) in the informal market outlet. Because most of the informal buyers do not offer credit to farmers, it reduces their probability of choosing this outlet by 29.3%. In the formal markets, farmers are affiliated to cooperatives which offer a range of credit products such as feeds, drugs, and veterinary services to farmers who supply their milk through them. According to Kembe and Charles (2016), credit access as factor influence choice of an outlet mainly because the smallholder farmers are able to increase their productivity through the use of available capital. The unavailability of credit in the informal market therefore impacts negatively on the producers' ability to choose the markets which offers credit to the farmers.

Conclusion

Nine factors were found to be significantly influencing the choice of milk marketing outlet in Kuresoi sub county. The factors were: Occupational status, group marketing, number of cows owned, price information, type of dairy breeds, milk volume distance to market, neighboring effect and distance to market point. Based on these results; amount of milk produced by the farmer, group marketing and price of milk highly influenced the market outlet choice. Group marketing positively influences the formal market as a choice of marketing outlet and negatively influences the informal marketing outlet. Price information informs the farmer on prevailing pricing condition. This shows that the farmers who market their milk to informal market do not incur higher transaction cost like famers selling to formal or both informal and formal marketing outlets.

RECOMMENDATION

As one of the key factor to increase farmers income and milk market outlet choices due to the fact that smallholder dairy farmers are becoming more market oriented, so extension workers need to be in position to advise them not only on how to select cattle breed requirement to increase milk production but also on the choice of market. It is also quite important that the outlets be promoted to maximize the economic benefit of farmers. Marketing training for extension workers is therefore vital and thus extension services should be strengthened to enable the farmers make good marketing decisions by producing in accordance to marketing requirement of milk.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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