


## Research Article

# Dairy Farmers' Choice of Milk Market Outlets: Evidence from Farm Households in Central Ethiopia

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This study examines dairy farmers' choices of marketing channels and factors that determine their choices using primary data collected from households in central Ethiopia. We use the multinomial logit model to analyze the data and investigate factors affecting farmers' choices of whether to sell to local consumers market, cooperative unions, hotels/restaurants, or milk processing plants. The results show that households' number of milking cows, household size, and the relative price of milk increase farmers' likelihood of choosing the milk processing plant channels compared to local milk consumers. Access to information, dairy farming experience, cooperative membership, and market information increase farmers' probability to choose cooperative market outlets while access to dairy extension services and modes of payment affect farmers' choices of hotel/restaurant channel. These findings imply that creating better extension services and information can improve farmers' awareness and the need to increase market efficiency through farmers' development capability to organize and access to updated information and better marketing channels.

## 1. Introduction

Currently among agricultural GDP, the livestock subsector contributes 40–45%. Consequently, livestock provide a living for 75% of people in rural areas and 25% of people in urban areas worldwide [1]. The sector includes smallholder mixed farming and pastoral systems and is the backbone for the livelihood of rural households for their incomes, nutrition, food security, and manure [2, 3]. The average dairy milk consumption is about 105 and 40 liters per annum per capita, in the world and Africa, respectively, whereas in Ethiopia, the average annual consumption is less than 19 liters [4]. Agricultural products marketing is vital in improving farmers' livelihood and reducing poverty; however, smallholder farmers are experiencing different obstacles, such as short fall infrastructure, schooling problem, and information asymmetry with marketing [5]. For example, a finding in South Africa by [6] milk marketing is challenging by producers due to insecurity in own to assets,

access to local market, and extension education. In addition, a review of empirical study on the status, opportunities, and challenges of milk production in Kenya and China shows that milk marketing is currently facing some difficulties, such as poor road infrastructure, poor marketing itself, high costs and unavailability of input services, and limited value addition of milk and dairy products [7, 8].

In Ethiopia, some studies revealed that dairy consumption is too low. A finding in [9, 10] in Addis Ababa, Ethiopia, shows that about 10.2 kg of the whole milk production and 8.5 liters of milk per adult are equivalent annually. Ethiopia has a slower milk supply than Kenya despite similar environmental conditions, and Kenya has a higher success rate in the milk subsector [11, 12]. The inappropriate dairy development and value chain of marketing cause such a milk supply shortage [13, 14]. In Ethiopia, only 5% of the total dairy produced by smallholder farmers is sold in commercial markets, with the remaining 95% being consumed domestically [15]. Due to population growth, there is

a significant gap between supply and demand for dairy products in both rural and urban areas, with a lower supply in cities [16]. Over 95% of the milk that is sold in Ethiopia goes through the unofficial milk marketing system [17, 18]. Milk products may be distributed informally from producers to consumers or through a small number of market intermediaries [19, 20]. However, in the official marketing, cooperative unions and the private sector distribute milk and milk products. Both consumers and large milk enterprises collected products of milk at collection centers that were delivered by producers in urban towns [21, 22]. In the capital city (Addis Ababa), there are not many milk processing facilities that are both government and privately owned and operated [23].

A study in [24] found out that direct sales to local customers, sales to traders or vendors, sales to cooperatives, and sales to processing plants are some of the options available to producers for selling their products [24]. A study examined by [25] the factors that influence smallholder dairy farmers' decision regarding the marketing channel they use and the extent to which their market preference affects the level of commercialization or market participation. According to the aforementioned study, marginal and smallholder producers could scale up their milk production and subsequently commercialize their milk businesses given the proper incentives and market infrastructure. Evidence from various studies [26–28] points out that milk and milk-related production and processing and access to extension services emerged as the most important policy recommendations. In general, several studies dealt with factors affecting the milk market in different areas, likewise [29] studies examined the results of the cow milk market in Ethiopia. However, no study has been conducted on dairy farmers' choice of milk market outlets in Sululta woreda. For this study, we used a multinomial logit model to study farm households' choices of milk market channels and the factors that determine their choices. Hence, empirically, it is intended to study dairy farmers' market choice level, depict the extent of variables effect, and identify the key variables on which policymakers will have to focus to improve the farmers' milk market choices. There is no solitary best channel chosen by the small sale farmers in the study area. It also included two facets, technical and institutional factors, deemed to affect market channel choices missing the socioeconomic factors.

*1.1. Theoretical and Conceptual Frameworks.* Under the theoretical frame work of economics, there is no solitary channel to sell the product; therefore, choosing and making a decision one among the given marketing channels by producers is a matter of choice often called science of choice [30, 31]. The rationality principles of the theory are used to guide this science, which entails looking for the most economical ways to accomplish a particular objective [31].

Rational choice theory: this theory is primarily employed by social scientists, with economists specifically referring to it as the economic approach or the approach to rational optimization [32, 33]. Similar to

other theories, it draws conclusion and made assumptions based on deductive reasoning “what ought to be,” even though the scenario is not fully described. Supporters of the rational choice hypothesis assert that it offers a coherent and rigorous framework for comprehending human behaviors and actions, as well as an analytical tool for connecting aggregate events to actual contexts where people make decisions [33].

The decision theory: this theory helps to reach in a better decision from the given alternatives and a range of options by laying down strategies using the utility function of payoffs; it is derived from economics [34]. This study was based on the producer market participation theory of utility maximization [35].

## 2. Methods and Materials

*2.1. Description of the Study Area.* Sululta woreda, the study area as depicted in Figure 1, is one of several unique zones in the Oromia Regional State close to Addis Ababa. The region is made up of 3 towns, 23 kebeles, and 115,123 hectares of land. Chanco, the capital city of the Woreda, is located 40 kilometers northwest of Addis Ababa at 9° 11' 0" N latitude and 38° 45' 0" E longitude. A distinctive feature of the region is its shallow valleys, which are nearly mountainous at a height of 2500 meters above sea level and have a number of minor rivers and tributaries that flow into the Muger River. With an average annual rainfall of 1119 mm, the temperature is roughly 14.70 C on average. The population of the woreda was estimated to be 149,494; 74,753 of those were men, and 74,741 were women. The woreda's estimated population density is 136.1 people per square kilometer. Although agriculture is the region's main source of income, managing crops and raising livestock are the region's two main sources of income. Livestock are fed on grazing land, hay, and crop waste. In the study area, dairy farmers sell their milk through a variety of channels, including cooperative dairy marketing organizations, milk processing businesses, lodging and dining establishments, and/or local consumers.

*2.2. Sampling and Methods of Data Collection.* Small-scale dairy producers in the Sululta woreda are the study's target population, and we choose sample respondents using a multistage sampling procedure. First, the Sululta district is purposely selected due to its current growing dairy producers. The woreda includes 26 subadministrative woreda/kebeles, has the potential to produce dairy products, and benefits from market access to Addis Ababa, the nation's capital [36]. The plain is wetland, especially during the rainy season, but it is highly suitable for grazing when the season becomes dry. We randomly select six sample subworedas/kebeles, from a total of 23: these are Chanco-Buba, Gorfo, Moye-Gajo, Waju-Dalo, Wererso-Malima, and Wererso-Galayifrom. According to data from the woreda office, there are a total of 835, 814, 634, 858, 687, and 528 dairy producers in each sample subdistrict administration, respectively [37]. Finally, we use systematic random sampling

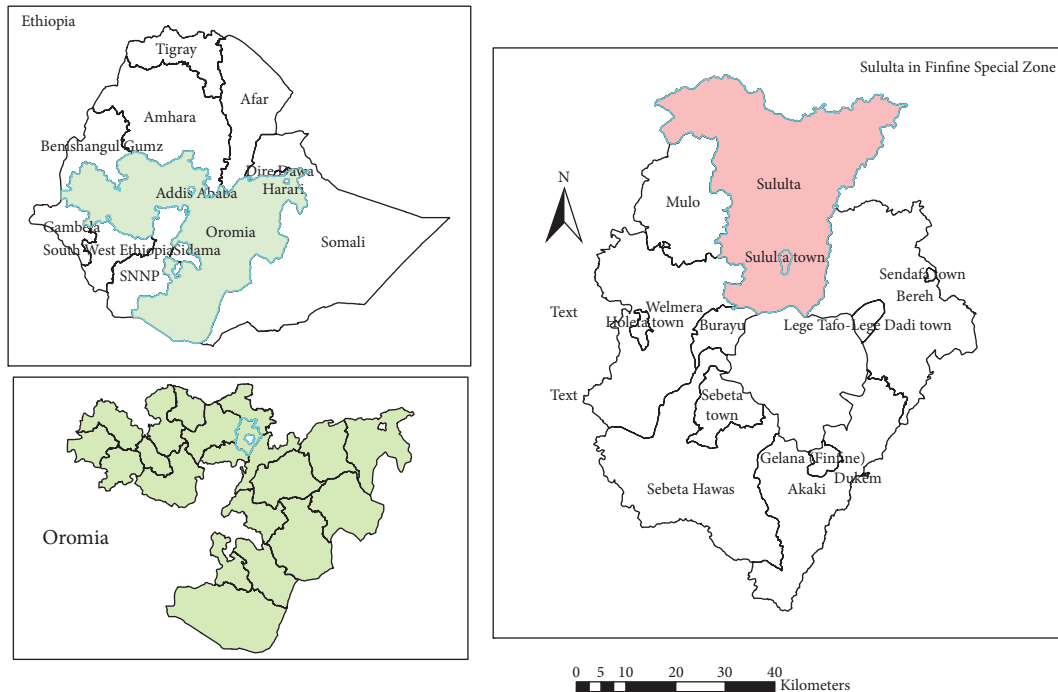


FIGURE 1: Map of the study area. Source: authors' computation based on the recent Ethiopian Administration Boundary Shape file, 2023.

to choose 150 households using proportional sampling, and the proportion of samples from the study in kebeles is shown in Table 1. We choose the sample households from the list of names provided by the offices of livestock and agricultural development in each kebele/the lowest administrative unit. We also consult the district's livestock and agricultural development experts for more information about the dairy farms that are currently operating in the study area.

For this study, we mainly use primary data collected on smallholder households engaged in dairy production. The information on the dairy farmers' socioeconomic characteristics, milk production activity, choices of milk market channels, etc., is collected in a face-to-face interview, observation, and focus group discussions and using a nonstructured questionnaire. We also use secondary data collected from woreda agriculture and trade office reports to substantiate the findings. The data collected on farmers' choices of milk marketing channels and socioeconomic and institutional factors affecting their use of milk supplies and marketing decisions include both quantitative and qualitative types. Finally, we use descriptive statistics and discrete choice econometric models to analyze the data to address the stated objectives.

**2.3. Data and Data Types.** In an attempt to explore the determinant of household's market channel choices for milk supply, we review related empirical studies like [11, 12, 36] to identify relevant variables and include them in the model. The definition and summary of the variables that are part of the model are provided in Table 2. The household characteristics that were distributed among the four milk market outlets are shown in the table.

**Local consumers:** these are the primary beneficiary of the milk product delivered from the producers.

**Cooperatives:** in this context, they are "an autonomous association of persons united voluntarily to meet their common economic needs and aspirations through a jointly owned and democratically-controlled enterprise" buying milk from producers and selling for their customers.

**Hotels/restaurants:** Organizations/businesses that provide food delivery services in these areas purchase milk and milk byproducts from the producers.

**Milk processing plants:** these locations are the locations where milk or milk products are gathered from the producers, handled, processed, stored, pasteurized, aseptically processed, bottled, or ready for distribution.

Communities in the study region have a variety of options for selling their milk products, including neighborhood residents, cooperatives, hotels and restaurants, and milk processing plants. According to the secondary data shown in Table 2, 32% of dairy farmers sell their milk products to milk processing plants, 15% to hotels/restaurants, and 25% to cooperative unions and 28% of producers sell their milk products directly to local consumers. Furthermore, according to the information obtained from the woreda office, farmers in the study area produce 28 liters of milk per household per day on average, with 20% of households using their milk production for domestic consumption and the remaining 80% being sold in the market.

TABLE 1: Sample subdistricts, total dairy-producing households, and the sample size to be taken from each subdistrict.

Subdistrict names	Dairy producer households	Percentage	Sample households
Chancho-Buba	835	19	28
Gorfo	814	19	28
Moye-Gajo	634	14	21
Waju-Dalo	858	20	30
Wererso-Malima	687	16	24
Wererso-Galayi	528	12	18
Total	4356		150

Source: authors' survey computation, 2020.

**2.4. Model Specification and Data Analysis.** Conventional microeconomics theory posits that individuals are rational and possess consistent preferences that are defined over a set of choices. The dependent variable in this study is the categorical result of the farmers' selection of the marketing channel, which has four unordered alternatives. The independent variables are the features and attributes of the alternatives as well as the characteristics of the farmers themselves. For the purpose of this study, the data are analyzed using the multinomial logit (MNL) model. The model allows for the analysis of choices made in a variety of categories for the dependent variable, and its probability formula is closed-form and simple to understand [38]. We have also used the multinomial probit model to account for the effect of the violation of the absence of unnecessary alternatives (IIA) property even if the interpretation is based on the estimation from the multinomial logit model. The general form of the multinomial logit model is as follows [39]:

$$P_{ij} = \frac{\exp^{x\beta_j}}{1 + \sum_{j=1}^J \exp^{x\beta_j}}, \text{ for } i = 1, 2, \dots, N; (j = 1, 2, \dots, J), \quad (1)$$

where  $P$  is the likelihood that a household will select option  $j$  from among  $K$  milk market channel options. The socioeconomic and demographic characteristics of the household are contained in the vector of explanatory variables  $X$ , and the vector of parameters  $\beta_j$  links the explanatory variables to the valuation of  $K$  outlets ( $K = 1, 2, \text{ and } 3$ ). The multinomial logit regression's marginal effects and predicted probabilities are as follows:

$$\frac{\partial P_{ij}}{\partial x_{ij}} = P_{ij}(\beta_{ij} - \sum P_{ij}\beta_j), \quad (2)$$

where  $\beta$  and  $P$  stand for the parameter and probability of one of the options, respectively. While keeping the other independent variables at their sample means, marginal probability provides more accurate indications and represents changes in one independent variable. In order to produce consistent, asymptotically normal, and effective estimates, the model is estimated using maximum likelihood techniques. In order to examine the factors that influence farmers' choice of marketing channels, the multinomial logit model used in this study includes socioeconomic variables such as household head's age, education, gender, household income, size of the landholding, number of milking cows,

and household head count. In addition, elements such as availability of extension services, cooperative membership, prices, and market information are taken into account to see if they affect farmers' decisions regarding the markets they choose to sell their produce in.

### 2.5. Definitions of Variables and Hypothesis

**Milk marketing channel (CHACO):** the variable CHACO is a dependent variable that is categorical and represents the milk market outlet or channel used in the study area. The regression analysis considered households with access to individual consumers, cooperatives, hotels/restaurants, and dairy processing outlets. The dependent variables were created based on the sales made to these channels. There were no set guidelines for selecting the independent variables to be included in the econometric model [40, 41] but empirical research and economic theory were used to identify the variables that influence milk market channel choice [42]. The model included various socioeconomic, demographic, and institutional factors to explain the variation in dairy farmers' choices for milk market channels.

**The household head's age (AGE):** the age of the household's head is indicated by the continuous variable "AGE," which is expressed in years. Older household heads are believed to be resourceful, which is anticipated to positively affect their households' likelihood and rate of dairy market participation as well as their preference for market outlet [43]. Therefore, it is assumed that the age of the household will favorably influence the selection of milk market outlet.

**The head of the household's sex (SEX):** the binary variable "SEX" has a value of "1" if the head of the household is a male and "0" otherwise. In the study area, women generally provide more labor for various aspects of raising livestock and selling dairy products. However, female-headed households may have a lower participation in livestock markets due to a variety of factors, including a lack of resources and limited access to credit and extension services [44]. On the other hand, households headed by men are anticipated to be more market-oriented and to participate more in the milk market as a result of their potential advantages in the dairy industry. The choice of milk market outlet is therefore predicted to be positively impacted by the variable "SEX."

TABLE 2: Definition and description of the explanatory variables and distribution of household characteristics by their choices of milk market outlets.

Variable names	Definitions and descriptions of variables	Individual consumers 30 (28%)	Cooperative 33 (25%)	Hotel 18 (15%)	Processing plant 39 (32%)
SEX	Sex of the respondents (dummy: 1, male and 0, female)	80	69.7	66.7	77
AGE	Age of respondents (years)	20	30.3	33.33	23
FAMSI	Family size (adult equivalent) (number)	40.67	42.15	40.89	43.33
EDU	Educational status of family head (years)	2.4	2.94	2.83	2.79
DIST	Distance to the adjacent urban market (KMs)	8	7.5	9	11.4
EXT	Dairy extension services (Dummy: 1, yes and 0, no)	2.3	2	1.8	1.5
NCOW	Number of owned milking cows (TLU number)	73.33	51.52	5.56	46.15
EXPE	Dairy farming experience (in years)	2.90	3.06	3.22	3.38
LAND	Total landholding (hectares) average	14.17	15.75	14.39	14.15
CHILD	Children under six years old in number in average	1.82	1.52	1.54	1.7
ACC	Credit access (dummy: 1, yes and 0, no)	3	2	2	2
MEMB	Membership to cooperative (dummy: 1, yes and 0, no)	66.67	54.55	33.33	69.23
PRICE	Milk price per litter (in Birr)	33.33	45.55	66.67	30.77
INFOM	Access to market information (dummy: 1, yes and 0, no)	43.34	93.94	27.78	56.41
POM	Credit payment mode (dummy: 1, yes and 0, no)	56.66	6.06	72.22	43.59
VMM	The volume of dairy milk supplied to the market (daily)	15.8	16.00	17.72	17.31
		53.63	75.65	66.73	58.97
		46.63	24.35	33.27	41.03
		33.33	54.55	34.33	69.23
		66.67	45.55	65.67	30.77
		26.6	28.8	29.2	30.8

Source: authors' survey computation, 2020.

Family size (FAMSI): the variable “FAMSI” is a continuous variable that is based on how many people live in a given household. Greater home consumption needs are related to larger households, which could result in lower milk market participation [44, 45]. Larger households, however, might also have more free labor, which would result in higher milk production and a greater willingness to engage in marketing [46]. As a result, both positive and negative effects of family size on milk market outlet choice are hypothesized to exist.

Educational status (EDU): the length of the household head’s formal education is represented by this continuous variable, which is measured in years. Higher education levels are anticipated to lead to better decision-making abilities in terms of market participation and a greater understanding of market dynamics [46]. The choice of milk market outlet is therefore predicted to benefit from the household head’s higher education levels.

The number of milking cow (NCOW): it represents the number of milking cows owned by a household, measured in TLU, and is a continuous independent variable. It is anticipated that as the number of dairy cows owned rises, milk sales will rise, milk production will rise, and the percentage of consumption will decline [47]. Previous research has demonstrated a significant and positive relationship between this variable and the volume of marketable milk and market participation. Therefore, it is assumed that this variable will have a favorable impact on milk sales via the best channel option.

Distance to urban center (DIST): the DIST variable indicates how many kilometers separate a household’s location from the closest urban center. Less travel time and money are spent getting there and facilities and market information are easier to access. An adverse correlation between market participation and proximity to the urban market center has been found in earlier studies [47, 48]. So, it is assumed that households farther away from the closest urban market are more likely to frequent cooperative milk market outlets than other milk market outlets.

Extension services (EXT): if a household had access to dairy extension services, this independent variable will take the value of 1; otherwise, it will take the value of 0. According to earlier research, having access to extension services can increase household knowledge and proficiency in dairy production and marketing, which in turn can have a positive effect on milk market channel preferences [48, 49]. This variable is therefore predicted to have a favorable impact on the selection of milk market outlet.

Dairy farming experience (EXPE): the variable EXPE represents the duration of a household’s involvement in dairy farming; it is anticipated that households with more experience will be more knowledgeable about the

opportunities and difficulties in dairy production, processing, and marketing [50]. This variable was included in the probit model, which discovered a favorable relationship between it and the preferred milk market outlet. Therefore, it is assumed that EXPE has a favorable effect on consumers’ channel preferences and supply in the milk market.

Land size (LAND): this is an independent variable with a hectare unit of measurement. While previous research [51] found a link between milk market channel preference and landholding size that was negative; it is predicted that the variable will influence milk market channel preference in this study.

Children present under the age of six (CHILD): the dummy independent variable called CHILD has a value of 1 if a household has at least one child under the age of six and a value of 0 if it does not. As per previous research in [44], there is competition between milk for children and milk intended for the market, which affects the supply and market outlet choices. Based on these results, it is hypothesized that the variable CHILD will have a negative impact on the channel choice for the milk market.

Credit access (ACC): it is a binary independent variable with a range of 0 to 1 depending on whether the household has access to credit. Previous research [52] found a correlation between milk producers’ level and level of participation in the supply of milk to the milk market and their access to credit. By enhancing dairy households’ financial capabilities through access to credit, more improved dairy cows and other inputs can be purchased, leading to an increase in milk production and market supply participation. Therefore, it is hypothesized that having access to credit will have a positive impact on both the supply of milk on the market and the decision of the best channel for selling milk.

Milk price by a market outlet (PRICE): the variable PRICE, which is measured in Ethiopian Birr, represents the actual price a household pays for each liter of milk sold to milk market outlets. An investigation in [53] suggests that a household is more likely to prefer that outlet for obtaining and selling milk if the price offered by a specific milk market channel is higher. Therefore, it is predicted that choosing the best milk channel will be positively impacted by the PRICE variable.

Participation in a cooperative (MEMB): if a household belongs to a cooperative, it has a value of 1; otherwise, it has a value of 0. According to research, households that belong to cooperatives are more likely to sell their milk to milk processing cooperatives rather than to individual consumers or hotels/restaurants [54]. The choice of market outlet is therefore predicted to benefit from membership in a cooperative.

Access to market information (INFOM): if a household has access to market information services, it will take the value 1; otherwise, it will take the value 0.

Information about market prices is essential to household purchasing choices. Ineffectively integrated milk markets could give consumers inaccurate price information, which would result in ineffective product movement. A study in [55] on the marketing of food found that households' likelihood of participating in the market was significantly increased by better market knowledge. As a result, it is hypothesized that having access to market information will influence both the selection of milk market outlets and milk marketing supply favorably.

### 3. Results and Discussion

**3.1. Econometric Results.** Table 3 presents the econometrics regression results of this study and the significant variables incorporated in the model are discussed as follows. The log pseudolikelihood value of  $-94.787$  of the unrestricted models indicates the overall model is important, and the predictor variables significantly explain the variation of choice of the milk market outlets among the households. The pseudo of  $R^2$  of  $0.416$  indicated in Table 3 is high, and the model's  $P$  value suggests that it fits the data well. According to the findings, a  $P \leq 0.001$  and a chi-square test value of  $134.77$  indicate a significant difference at a one percent significant level. The overall model is significant as a result, which means the explanatory variables in the model adequately account for the variation in farmers' preferences among the three market outlets. Separate estimation of these channel selections is subject to bias, and household selections of the four channels are interdependent. The mean of all the sample variables is used to calculate the marginal effect, while dummy variables are calculated using the discrete change in probability.

Table 3's conclusion demonstrates the importance of the model's included variables collectively in explaining the differences in the producers' market outlet preferences. The results show that the variables cooperative membership, farmers' diary experience, access to information, number of children in the household, and households' milking cows have positive and significant coefficients in explaining on the choice of farmers using the cooperative market channels. This shows that small-scale milk producers who have access to better market information, cooperative membership, and a greater number of milking cows are more likely to use the cooperative market channel than the direct consumer market channel. A large number of milking cows may be associated with larger milk production thus increasing the use of cooperative channels than selling milk at a local market. Dairy farmers with a larger number of children and household size are also found to be more likely to use the cooperative market channels. Table 3 shows that dairy farmers' experience, market information, and cooperative membership increase farmers' likelihood of selling their milk to cooperative unions compared to directly selling to local consumers. On the other hand, the average selling price in cooperatives is lower and found to have no significant effect on the farmers' likelihood of using the cooperative outlet. In other words, cooperative membership has a negative

coefficient and indicates that cooperative membership reduces farmers' likelihood of using local individual outlets.

Likewise, Table 3 shows that the coefficients on household size, number of children, price, number of owned milking cows, extension services, cooperative membership, and payment modes are statistically significant at five significance levels in explaining the choice to use the hotel/restaurant market channel. Households with larger family members, a larger number of children, a large number of owned milking cows, cooperative membership, and the likelihood that access to extension services use hotel/restaurant market channels than directly selling to local consumers. In addition, the results indicate that higher prices in the hotel/restaurant outlet increase the use of the outlet while monthly credit payment mode reduces the use of it by the farmers compared to the use of local consumer market outlets.

Table 3 shows that the coefficients of the variables price and the number of owned cows are consistently positive and at a five percent statistically significance level in explaining farmers' choice of milk processing plant channel to sell their milk products. It is discovered that dairy farmers' likelihood of selling their milk to milk processing plants as opposed to selling to local individual consumers is positively and significantly influenced by the number of milking cows owned by households. As milking cow ownership by a TLU increases, the marginal effect result shows that farmers are more likely to sell milk to milk processing plant outlets as opposed to local consumer market outlets. The findings of [56] revealed that the farmers' number of milking cows significantly affects their choices of milk market outlets. Contrarily, it has been discovered that households with access to credit are less likely than households without access to credit to sell their milk products to milk processing plants. Male and relatively older household heads are also found to be less likely to choose hotel/restaurant channels compared to female and younger household head counterparts. Households' access to credit increases the use of local consumer market channels compared to selling to milk processing market outlets.

**3.2. Discussion.** According to the findings, both institutional factors and farmers' demographic characteristics are what account for the variations in the milk market channels they choose. For example, the results indicate that access to information, extension services access, credit access, cooperative membership, and payment mode have significant effects in explaining farmers' choice of market channels. In comparison to accessing the local consumers' market channel, dairy households with access to extension services are more likely to choose the hotel/restaurant milk market channels. The marginal effect demonstrates that dairy farmers who have access to extension services have a higher likelihood of accessing the hotel/restaurant milk market channel than those who do not. The implication is that extension services such as milk technology, extension knowledge and skill, training, field visits, and home visit received by dairy farmers have an impact on their milk

TABLE 3: Results of multinomial logit regression on farmers' choices of milk market outlets using direct sales to a local consumer as base category.

	(1)	(2)
<i>Mlogitmprobit</i>		
<i>Cooperatives</i>		
AGE	-0.160 (-1.72)	-0.122 (-1.87)
GEN	-0.753 (-0.84)	-0.374 (-0.59)
HSIZE	0.944 (1.78)	0.702 (1.79)
EDU	0.124 (0.16)	0.00463 (0.01)
NCOW	1.126* (2.00)	0.772 (1.92)
DIST	0.659 (1.27)	0.486 (1.34)
EXTE	0.259 (0.33)	0.0199 (0.04)
EXPE	0.256* (2.32)	0.193* (2.41)
LAND	-1.541 (-1.84)	-1.203* (-1.98)
CHILD	1.986* (2.32)	1.582** (2.61)
ACC	-1.814 (-1.74)	-1.185 (-1.73)
PRICE	0.0619 (0.28)	0.0694 (0.48)
MEMB	4.264*** (3.87)	2.896*** (4.11)
INFOM	1.535 (1.93)	1.104* (1.97)
POM	-0.251 (-0.32)	-0.114 (-0.20)
_Cons	-5.692 (-1.00)	-4.167 (-1.12)
<i>Hotels_Restaurant</i>		
AGE	-0.272 (-1.94)	-0.208* (-2.11)
GEN	-1.819 (-1.67)	-1.126 (-1.47)
HSIZE	1.750* (2.48)	1.262* (2.56)
EDU	-0.680 (-0.76)	-0.444 (-0.68)
NCOW	2.102** (2.78)	1.533** (2.89)
DIST	0.344 (0.48)	0.178 (0.37)
EXTE	4.358** (2.72)	2.985** (2.80)
EXPE	0.163 (1.14)	0.127 (1.27)
LAND	-0.643 (-0.61)	-0.700 (-0.95)
CHILD	2.356* (2.26)	1.669* (2.26)
ACC	-1.288 (-0.99)	-0.943 (-1.07)
PRICE	0.804** (3.00)	0.552** (3.22)
MEMB	3.075** (2.64)	2.274** (2.71)
INFOM	0.0184 (0.02)	0.205 (0.29)
POM	-3.085** (-2.70)	-1.996** (-2.71)
_Cons	-18.13* (-2.32)	-11.98* (-2.39)
<i>Processing plants</i>		
AGE	0.0251 (0.30)	0.00623 (0.11)
GEN	-0.603 (-0.68)	-0.276 (-0.44)
HSIZE	0.595 (1.27)	0.501 (1.44)
EDU	0.413 (0.59)	0.338 (0.65)
NCOW	1.801*** (3.33)	1.286*** (3.42)
DIST	0.885 (1.85)	0.672* (1.99)
EXTE	-0.111 (-0.15)	-0.00870 (-0.02)
EXPE	0.0337 (0.32)	0.0339 (0.46)
LAND	-0.218 (-0.27)	-0.215 (-0.39)
CHILD	0.846 (1.14)	0.624 (1.14)
ACC	-2.462* (-2.54)	-1.738** (-2.63)
PRICE	0.587** (2.97)	0.428** (3.16)
MEMB	1.328 (1.82)	0.859 (1.63)
INFOM	0.442 (0.62)	0.345 (0.67)
POM	0.614 (0.81)	0.469 (0.86)
_Cons	-19.16*** (-3.54)	-13.86*** (-3.95)
N	120	120
r2_ct	0.442	
r2_ctadj	0.230	
aic0	2.646	
aic_n	317.6	

\*\*\*, \*\*, and \* indicate the significance level of 0.1%, 1%, and 5%, respectively ( $*p \leq 0.05$ ,  $**p \leq 0.01$ ,  $***p \leq 0.001$ ). The numbers written in brackets indicate *t*-statistics.



marketing channel choices. Similar studies show a positive relationship between a visit by an extension agent and milk market channel choices [47]. The higher price in the hotel/restaurant market channel and cooperative membership also increases the choice of hotel/restaurant channel while the use of credit discourages it. The likelihood of choosing hotels and restaurants over direct consumer market channels is also higher in households with a larger number of owned milking cows.

The likelihood of selecting the cooperative milk market outlet as opposed to the direct consumer market outlet is increased by dairy farming experience, market knowledge, cooperative membership, and the number of owned milking cows. The marginal effect finding demonstrates that the household's experience with dairy farming increases the farmer's likelihood of selecting the cooperative milk market outlet. The results also show that the relative price offered by a particular market outlet affects a household's probability of choosing milk market outlets. A related study in [57] also points out that milk prices influence households' choices of market outlets.

A farmer's likelihood of selecting a cooperative milk market outlet over a milk processing market outlet is increased by cooperative membership. According to the marginal effect, households that are members of the cooperative are 46.7% more likely to select and use a cooperative milk market outlet. Similarly, a study in [58] also found that a household's membership in cooperative unions positively affects their likelihood of choosing cooperative milk market outlet. According to Table 3's findings, there is a higher chance that consumers will choose the cooperative milk market outlet when they have access to market information. This result seems to support the idea that a farmer's willingness to select a particular marketing channel increases with the amount of market information the farmer has [42]. The mode of payment in milk marketing seems also to affect farmers' choice of market outlets, because farmers may prefer to choose milk processing plants and cooperative union market outlets for the benefit of getting cash payments, advance payments, or credit payments. The study in [42] also indicates that households are more likely to select market channels that paid cash on hand compared to channels that offer monthly payments.

The result also demonstrates that dairy farm households are more likely to sell their milk at local independent milk markets than at milk processing market outlets when they have access to credit. The lower cost of local consumers and the distance to the closest market, on the other hand, make using the local consumer market outlet less likely. In addition, households that belong to cooperatives and have a greater number of milking cows which are more likely to sell their milk to processing facilities, where the average selling price is higher than selling it directly to local consumers. Our result is consistent with those of [25, 59, 60] which revealed a larger number of cows that implies a larger volume of milk produced is associated with the choice of cooperative channel compared to directly selling to local consumers. According to the marginal effect finding, the probability of choosing the local consumer market outlet by

the dairy farmers with access to credit is higher than those without access to credit using the milk processing plant market outlet as a reference category. These results are consistent with the finding of [61] which reveals that access to credit helps farmers in expanding their scale of operation.

#### 4. Conclusion and Recommendations

Data on dairy farmers in Ethiopia's Sululta woreda are used in the study to examine the variables influencing farmers' decisions regarding milk marketing channels. We purposely selected six *kebeles* based on milk production and market potential and collected primary data through a semi-structured questionnaire distributed to 150 randomly selected sample respondents. According to the regression analysis, the differences in the farmers' preferences for milk market channels can be attributed to access to credit, farm experience, cooperative membership, access to dairy extension services, and access to market-related information. The price offered by the milk outlets and the mode of payment are also important factors in influencing the choice of market outlets.

The results show that expanding access to extension services and technical oversight by agricultural professionals and development specialists are crucial factors in enhancing farmers' use of marketing channels. That means extension services could help to improve farmers' attitude of the benefit of milk marketing and awareness on the decision to choose the best milk market outlets. Only 52% of households accessed market information services implies the need to increase market efficiency by building farmers' capability and accessing updated information. The findings also indicate that the absence of access to credit services from formal financial sources for dairy farmers hinders the choices of farmers for high-paying marketing channels such as cooperatives and milk processing plant outlets in particular and the development of dairy farming in general. On the other hand, cooperative membership, improved access to information, and credit access could encourage farmers to expand the dairy business and choices of better marketing channels. Milk processing plants in areas where there is high milk supply potential but limited access to the market can create enabling and supporting environment for existing cooperatives.

#### Data Availability

The original data generated during the study and used in this paper are available from the corresponding author upon reasonable request.

#### Ethical Approval

This research has received ethical approval from Mekelle University.

#### Conflicts of Interest

The authors declare that there are no conflicts of interest.

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