



Exploring Institutional Dynamics in Milk Marketing: A Case Study of Eastern Tigray, Ethiopia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Institutional set-up assists and facilitates transaction of products especially like milk that need immediate exchange due to easily spoilage nature. Studies focusing on institutional analysis in dairy marketing have not been done in the study area so far. Thus, this study was conducted to analyze the institutional set-up of milk marketing in WukroKilteawlalo, Tigray. Primary data were collected using a structured questionnaire from samples selected through a two-stage random sampling technique. Descriptive statistics and an econometric model were used to analyze the data. In the probit model, the amount of milk produced per day and membership in a milk cooperative increase the likelihood of using a contract, whereas age, non-farm income, and market distance decrease the probability of dairy producers using contract sales. The study has also

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revealed that due to lack functioning of formal institutions, the informal institution dominant in the dairy marketing. Institutional, production and marketing challenges for dairy marketing were identified. Thus, besides focusing on important significant variables in the results, policy makers should focus on devising appropriate dairy marketing policies, regulations, and rules. In addition to this, set up cooperatives and milk processor plants and link producers using contract sale.

Keywords: Institutional analysis; contract sale; probit model.

1. INTRODUCTION

Agriculture is the main engine of economy in Ethiopia. However, the performance of agriculture is poor due to the difficulty natural endowment, history of extractive policies and institutional problems. These problems include poor roads and telecommunications; poor human health; lack of a well-developed and diversified monetary economy; and thin markets for agricultural inputs, outputs, and finance, despite significant direct and indirect dependence of the local economy on agriculture [1]. Institutional set-up in dairy marketing supports and facilitates achieving good market performance in the milk producing areas. Institutional arrangement and institutional environment play a crucial role in facilitating any marketing in general and in dairy marketing in particular and increase satisfaction to actors in the dairy marketing. The production and marketing of milk and milk products requires more and more information flows and institutional arrangements among various supply chain stages due to its nature of complex with both formal and informal channels. There are various players in the dairy sector that play critical roles at different levels [2].

Effective institutions can help in translating and implementing policies and investments. Their role is critical in that well designed policies and investments can only be successful with the presence of well-functioning and effective institutions. The role of institutions, such as those that determine the rules of the game, the regulation and the enforcement of contracts and property rights, and the provision of public goods and services, is even more important when these institutions interact with markets [3]. In Ethiopia dairy marketing activities there are institutional setup problem. The producers claim that there is no promising price for their products as compared to the costs incurred for milk production and there are many other institutional factors that hinder to undertake well-functioning milk marketing activities. Consumers, cooperatives and processors, on the other hand, claim that there is shortage and unreliable supply

and quality of milk and milk products. These two paradoxes indicate that there is problem of institutional arrangement and institutional environment that play a crucial role in facilitating the dairy marketing and add satisfaction to all the actors in the dairy marketing [4].

Due to the favorable environmental conditions, rising population size in the urban areas the demand for dairy product is growing and it encouraging milk production and marketing in the country [5]. Therefore, there should be effective institutional set-ups that facilitate transaction of products. These kinds of products need modern type of institutional arrangements such as formal contractual arrangements in order to create reliable and quality supply. Agricultural marketing uses institutional arrangements such as contract, personalized transactions and spot markets [6]. These institutional arrangements in marketing create order; hence, they reduce conflicts and ensure mutual benefits for the marketing participant actors [7].

Despite the importance of institutional environments and arrangements in dairy marketing, there is no empirical evidence in the existing situation and problem with in this set up in milk marketing. Having accurate and reliable information about the status of institutional setup in the milk market has become crucial to investigate and forward policy and institutional options to encourage and create favorable marketing environment in the study area. Therefore, the purpose of this study was to identify the institutional environments and arrangements in milk marketing and factors that determine participation in contract sale of milk at household level.

2. METHODOLOGY

2.1 Description of Study Area

The study was conducted in WukroKilteawlalo district which is found in eastern Zone of Tigray Regional State, Ethiopia. The district is geographically located at an altitude of 1900-

2460 meter above sea level. The district is located at a distance of about 825 km from Addis Ababa and at a distance of about 44 km from the regional capital city, Mekelle. The mean maximum and minimum temperatures of the area are 23°C and 17 °C, respectively and average long-term annual rainfall is 400 mm. The district has a total area of about 1010.28 sq km and administratively covers 16 kebeles and 59 sub kebeles.

2.2 Sampling and Data Collection Method

In Wukro-Kilteawlaelo district there are 16 *kebeles* and have similar agro-ecological zone for dairy production. For this study, in order to select a representative sample, a two-stage random sampling technique was implemented to select milk producing households. In the first stage, out of 16 *kebeles*, 4 milk producing *kebeles* which are Agulae, Negash, Genfel and Adikisandid were randomly selected based on the lottery method. In the second stage, from the selected 4 *kebeles*, complete lists of all milk producers were prepared. From the list respondents were selected by simple random sampling method based on probability proportional to size. Sample size for the dairy producer households was determined using Yamane's (1967) simplified formula for sample size determination, that is,

$$n = \frac{N}{1 + N(e^2)} \quad n = \frac{3225}{1 + 3225(0.08^2)} \sim 139 \quad (1)$$

Where, n Sample size, N Total milk producer in the study area, and e^2 level of precision, that is, 0.08.

Out of the total 139 sample households only 71 households that participated in market were included in this analysis. Primary data were collected from milk producers using structured questionnaire. Focus group discussion and key informant interview was employed using checklists to obtain additional supporting information for the study.

2.3 Medel Specification and Data Analysis

Descriptive statistics and econometric model were used for analyzing the data. The descriptive statistics were used to describe the socio-economic and institutional characteristics of the milk producer households in the study area.

Furthermore, t-test, chi-square test and F-test were also used to compare different characteristics of farm households.

The formal and informal institutions and their roles in governing the various exchange arrangements were described. The interaction within the dairy producers and marketing actors were also analyzed. Levels of trust that the dairy producers have on dairy cooperatives were measured using Likert scales based on [8]. Cronbach alpha (α) is then used to measure internal consistency reliability of Likert-type items. Cronbach alpha is mostly used when the research being carried out has multiple-item measures of a concept [9]. The Cronbach alpha is calculated as:

$$\alpha = \frac{K\bar{r}}{(1+(K-1)\bar{r})} \quad (2)$$

Where: k = number of indicators or number of items, \bar{r} = mean inter-indicator correlation and α = percentage of the reliable variance

Cronbach alpha is expressed as a number between 0.0 and 1.0. A value of 0.0 means no consistency in measurement while a value of 1.0 indicates perfect consistency in measurement [9]. The acceptable range is between 0.70 and 0.90 or higher depending on the type of research. As a rule of thumb, a questionnaire with α of 0.8 is considered reliable.

Probit model convenient if data is normal distributed. In this study, probit model was used since the distribution of the data was normal distributed. The empirical specification of the probit model to be estimated by maximum likelihood estimation is defined as:

$$Y_i = \beta_0 + \sum_i^m \beta_i X_i + \varepsilon_i \quad (3)$$

Where: $i = 1, 2 \dots m$

Y_i , is a dummy variable indicating the probability of participating in contract sale that is related to the equation as $Y_i = 1$ if a farmer have been participate in contract sale, $Y_i = 0$, otherwise.

where, β_i , are the coefficients to be estimated, X_i , are explanatory variables in the Probit regression model and ε_i , is random error term

The probit functional form compels the error term to be homoscedastic because the form of probability depends only on the difference

between error terms associated with one particular choice and other. The marginal effects were estimated on the variable means. This calculation involves taking the partial derivatives that measures the change in the probability of getting access per unit change in the independent variables.

Variance inflation factor (VIF) was also used to test for collinearity among independent variables. VIF shows how the variance of an estimator is inflated by the presence of multicollinearity [10]. If R^2 is the adjusted square of the multiple correlation coefficients that results when the explanatory variable (X_i) is regressed against all the other explanatory variables. VIF is computed as follows:

$$VIF(X_i) = (1 - R_i^2)^{-1} \quad (4)$$

As the adjusted R_i^2 approaches 1, the VIF approaches infinity. That is as the extent of collinearity increases, the variance of the estimator increases, and in the limit it can become infinity. If there is no collinearity between explanatory variables, the value VIF is 1. As a Rule of Thumb values of VIF greater than 10, is often taken as a signal for the existence of multi collinearity problem in the model [10]. STATA version 12 was used to analyse data.

2.4 Variables Definitions and Hypothesis

Contractual Sale: This is dependent variable that is dummy variable and represents the probability of household use of contract in the milk market that takes a value of 1 if the dairy producer household sold milk through contract whereas it takes the value of zero if not use contract sale in milk market.

Age of the household head (AGEH): Age is an important variable which affects the decision behavior on using contractual forms or not in milk marketing. It is a continuous variable measured in years. This variable was expected to decrease the probability of dairy household's to use contract [11] on their study on "market participation behavior of smallholder dairy farmers in Uttarakhand: a disaggregated analysis" indicated that as age of household increases, the tendency to participate in formal milk marketing decreases.

Sex of household head (SEX): Sex is an important variable in marketing decisions even though it depends on roles and responsibilities in

different societies. Sex is a dummy variable that takes the value 1 if the household head is male, 0 otherwise. This variable is expected to affect the probability of engaging in contract sale positively.

Access to market information: It is dummy variable that takes a value 1 if obtained price information and 0 otherwise. This was hypothesized to have positive influence probability of engaging in contract sale.

Education level of the household head (EDUC): With the increase in the education level, the household increases the tendency towards modern marketing system such as contractual based agreements. It is a categorical variable [12] on their study showed that educational attainment had positive effect on the likelihood of participation in contractual agreement. This variable was expected to increase the probability of engaging in contract sale.

Family size (FMLYSIZ): This variable is a continuous explanatory variable and refers to the total number of family in the household and was expected to affect positively the probability of contract for selling milk.

Nonfarm Income (NFINC): It is a dummy variable and represents whether the household obtains income from different sources other than farm activities or not [12] found in their study that other income obtained from nonfarm activities had increased the probability to use contract agreement programs. Thus, this variable was expected to increase the probability of households in using contractual agreement with their buyers.

Cooperative Membership (COOPMEM): It is a dummy variable that indicates whether the dairy producer is a member of milk cooperative or not. This variable was expected to affect the likelihood of dairy producers use contractual agreements.

Volume of Milk Produced (VLMILK): It is a continuous variable and represents the total volume of milk produced per day and measured in liters. This variable was expected to increase the probability of household to use contractual agreements to sell milk.

Market distance (MKIDST): It is location of the dairy producer house from the nearest milk market and measure in kilometer. The

households in far distance need to increase their ties with buyers through contractual agreement. Hence, this variable is expected to increase the use of contractual agreement by producer.

Access to credit (CREDIT): Credit increases the financial capacity of households and they tend to expand their dairy business thereby increasing milk market participation. It is a dummy variable and it refers to whether the household has access to credit or not. This variable was then

expected to increase the probability of using contract to sale milk.

Number of Extension Contact (EXTCON): This is continuous variable which is the number of days that farmer had contact with extension agent. Those farmers who have more contact with extension agent are more likely to know the advantages selling milk to which they might get greater benefits. This variable was expected to increase probability of using contract to sale milk.

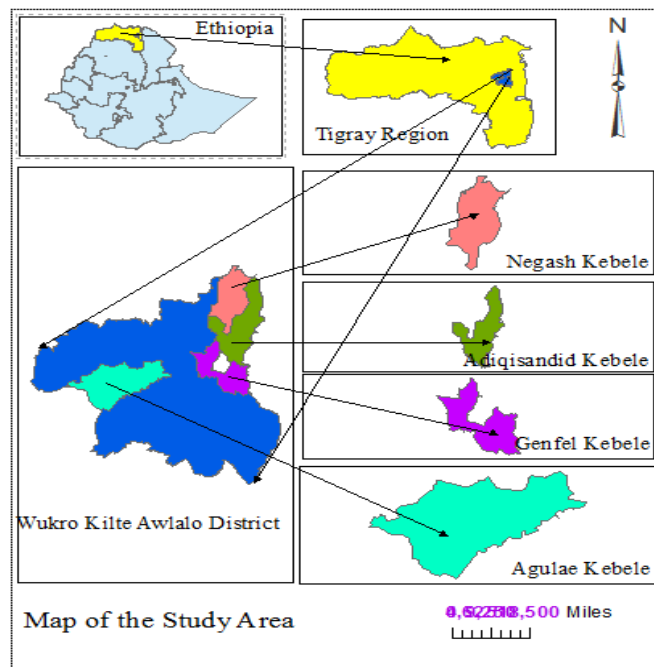


Fig. 1. Map of the study areas

Table 1. Definition and description of the explanatory variables and distribution of household characteristics by their choices of milk market outlets

Variable Name	Definition and description of variable	Household characteristics	
		Non contract (N=9)	Contract (N=62)
Sex of households head	1 if Male, 0 if Female	88.89	85.48
Family size	Continuous (number)	2.78	2.63
Education level of households	Illiterate	22.22	32.26
	Informal education	22.22	3.23
	Primary school	55.56	61.29
Market Distance to	Continuous (minutes)	1.69	3.11
Age of household head	Continuous (years)	49.77	47.9
Market Information	1 Yes, 0 Otherwise	16.44	14.25
Non farm income	1 Yes, 0 Otherwise	20	51
Cross breed cows own	Continuous (number)	0.42	1.67
Local breed cows own	Continuous (number)	0.59	0.64
Extension Contact	Continuous (number)	5.66	14.37
Milk output per ay	Continuous (liter)	7.16	15.36
Access to credit	1 Yes, 0 Otherwise	11.11	17.74
Cooperative membership	1 Yes, 0 Otherwise	22.22	67.61

Number of Milking Cows (Cross breed (CRSBRD), Local breed (LOCBRD): This variable is continuous and measured in number of milking cow owned. The milk contract sales are assumed to be positively influenced by the number of milking cows owned.

3. RESULTS AND DISCUSSION

3.1 Institutional Arrangements in Milk Marketing

In this study, one aspect of institutional arrangements, specifically contractual agreements, was examined. Two alternative institutional arrangements for milk marketing were observed, alongside the default non-contract option. The first alternative involved formal contractual arrangements, while the second involved informal contractual arrangements. Out of the total sample of dairy producers who sell milk, 62 (87.32%) used contractual agreements to sell their milk.

Formal contractual arrangements were practiced by 44% of the total sample of dairy producer households who sold milk under contractual agreements. This form of arrangement was based on a formal contract, which is a written agreement between producers and buyers of milk. In contrast, informal contractual arrangements were used by 56% of the sampled milk producers. These agreements were based on mutual understanding, without any written documentation, and the governing factor in these arrangements was trust.

The study observed that all dairy producers using formal contractual agreements sold their milk to dairy cooperatives, whereas those using informal contracts sold their milk directly to consumers and restaurants. About 51.9% of the terms of these agreements were based on the quality of

the milk, while 48.1% focused on the specific price of the milk. The study also showed that all formal contract users sold their milk collectively. The practice of selling in a group offers the advantage of reducing losses caused by market shortages, as the total amount of milk produced is supplied to the cooperative.

3.2 Relationships and Trust among Milk Marketing Actors

Trust is the most common informal institution practiced by trading partners in the study area. In dairy marketing, informal agreements based on mutual understanding or trust play an important role in the trading relationships between producers and buyers. The trade relationship between producers and buyers of milk—such as direct consumers and restaurants—is mostly informal, based on mutual understanding and trust. In contrast, the relationship between producers and cooperatives is governed by formal contractual agreements.

A Likert scale was used to measure the relationship and degree of trust that dairy producers have with cooperatives in dairy marketing. The study indicated that all 139 dairy producers (100%) reported having no relationship with traders or collectors, as there were no traders or collectors of milk in the study area. As shown in the table below, relationships with different actors in milk marketing were generally very weak. The study found that linkages between producers were weak; they did not have contact with one another regarding dairy production and marketing. Regarding relationships with direct consumers, 53.96% of milk producers reported having no relationship with consumers. Furthermore, 80.58% of the sampled producers had no relationship with cooperatives.

Table 2. Evaluation of relationship status of producers with milk marketing actors

Dairy Marketing Actors	Relationship status with dairy producers							
	No relation		Veryweak		Weak		Strong	
	N	%	N	%	N	%	N	%
Dairy producers	44	31.65	2	1.44	24	17.27	69	49.64
Collectors	139	100	-	-	-	-	-	-
Traders	139	100	-	-	-	-	-	-
Cooperatives	112	80.58	-	-	-	-	27	19.42
Consumers	75	53.96	-	-	31	22.30	33	23.74
Restaurants	127	91.37	-	-	12	8.63	-	-
Input suppliers	44	31.65	-	-	30	21.58	65	46.76

Source: Own computation from survey result, 2016.

Table 3. Trust status of member dairy producers on cooperative

Description	Scale							
	Strong disagree		Disagree		Agree		Strong agree	
	N	%	N	%	N	%	N	%
Cooperative establish to benefit producers	-	-	-	-	10	37	17	63
Cooperative has good relation producers	-	-	-	-	10	37	17	63
Cooperatives treat producers with care	-	-	-	-	26	96.3	1	3.7
The cooperative treats producers equally	-	-	1	3.7	10	37	16	59.3
The cooperative pays good price	-	-	14	51.9	12	44.4	1	3.7
Cooperative decisions benefit both side	-	-	-	-	26	96.3	1	3.7
Cooperative provides service as expected	2	7.4	14	51.9	10	37	1	3.7
The cooperative stands for members right	3	11.1	10	37	12	44.4	2	7.4
The cooperative creates market linkages	-	-	-	-	26	96.3	1	3.7

Source: Own computation from survey result, 2016.

Table 4. Reliability Statistics for milk cooperative members

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
0.732	0.876	10

Source: Own computation from survey result, 2016.

Table 5. Probit estimates of contract use of dairy producers for milk sale

Variables	Coef.	Robust Std. Err.	Marginal Effect
Constant	17.15***	5.01	
Sex of household head	0.02	0.76	0.000
Nonfarm income	-0.61*	0.356	-0.015
Age of household head	-0.689***	0.360	-0.017
Age square	0.008	0.008	0.000
Education level	-0.337	0.339	-0.008
Family size	-0.550	0.493	-0.013
Extension contact	0.995	0.959	0.058
Access to credit	-0.043	0.645	-0.001
Distance to nearest market	-0.302*	0.181	-0.007
Local breed cow	0.492	0.307	0.012
Crossbred cow	1.579	0.995	0.038
Market information	2.134	1.930	0.236
Milk produced per day	0.171*	0.103	0.004
Member to cooperative	0.329 *	0.174	0.009

Source: Own computation from survey result, 2016.

The trust that dairy producers have in different buyers and the government was also measured using a Likert scale with proxy variables (question items). Several issues were raised regarding the trust that member producers have in the cooperative. The survey results indicated that most of the sample dairy producers who were members of cooperatives had a high level of trust in the cooperative. However, there were also signs of dissatisfaction among members regarding several aspects. These included the price of milk paid by the cooperative, the services provided by the cooperative, and the

cooperative's advocacy for the rights of its members. Additionally, producers are dissatisfaction with the cooperative's treatment of its members, specifically regarding issues of equal treatment.

A reliability analysis was conducted on the sample of dairy producers who were members of the milk cooperative, using 10 items to test the reliability of the questionnaire. Cronbach's alpha (α) was used to measure the internal consistency of these items. As indicated by the results of the reliability analysis, the Cronbach's alpha

coefficient was 0.732, demonstrating that the questionnaire is reliable.

3.3 Econometric Estimation Results of Determinant of use of Contractin Milksale

To analyze the factors affecting households' use of contract to sale milk, probit model was used. The Chi-square value of 29.14 showed that likelihood ratio statistics significant at 1% level of significant suggesting that the model had strong explanatory power. The pseudo-R square was 0.4899 indicating the explanatory variable explained about 48.99% of the variable in the use of contract agreement to sale milk. Variance Inflation Factor (VIF) was used to test the collinearity among the explanatory variables and the explanatory variables that were less degree of multicollinearity used for the analysis. In the model estimation, a robust estimation technique was used to correct for minor heteroscedasticity problems.

Non farm Income (NONFARMINC): The model result revealed that non farm income affected the contract using behavior of dairy producer negatively and significantly at 5% significance level. Participation in nonfarm income generating activities decreased the probability of using contract agreement by 1.5%. This may be because as the dairy producer obtains other non farm income, they become more risk takers and they may not want to depend on contractual bases but want to sell to other alternatives for better prices. The result consistent with [13] who found that non farm income was negatively related to using contractual based transactions.

Membership to Milk Cooperative (COOPMEM): As expected, being member to dairy cooperative affected using contract agreement significantly and positively at 10% significant level. The marginal effect depicts that being membership to milk cooperative increase the probability of using contract agreement by 0.9%. Collective action institutions such as milk cooperatives encourage farmers to engage in formal contractual agreements [14].

Age of household head (AGE): This variable affected the decision of using contract salesignificantly and negatively at 10% significance level. As the age of the household head increases by one year, the probability of the dairy producer to use contractual agreement decrease by 1.7%. This implies that the younger

people are more active to use contract sale than the older households. Young people are more receptive to new ideas and are less risk averse than the older people [15].

Milk produced per day (MILKPERDAY): Amount of milk household produced per day was affected the use of contract agreement significantly and positively at 10% significance level. The marginal effect in the model revealed that as the milk production obtained per day increases by one litter, the probability of the dairy producer to use contract agreement increase by 0.41%. This may be due to the perishable nature of the milk,an increased amount of milk production forces farmers need to sale their milk in contract base in order to reduce milk spoilage.

Market distance (MRKTDIST): Distance was also another variable found to influence the decision of using contract sale. Market distance was significant at 10% and was negatively related to using contract agreement that shows as the farmer residence far from the point of sale by one km, the probability of using contract agreement decrease by 0.73%. As farmers become far from their market they may not have enough buyers and chances to sale milk in contract base.

4. CONCLUSION AND RECOMMENDATIONS

Institutional arrangement and institutional environment play a crucial role in facilitating any marketing in general and in dairy marketing in particular and increase satisfaction to actors in the dairy marketing. Despite the importance of institutional set-up in dairy marketing, the existing situation and problem with in this set up was not yet studied. Thus, this study was aimed to analyze the institutional environments and arrangements in dairy marketing in WukroKilteAwlalo in Eastern Zone of the Tigray National Regional State with the specific objectives of examining the institutional environments and arrangements and identify the determinant factors of contract use on milk market.

The result of the Probit model has also indicated that volume of milk produced per day and member of dairy cooperative positively and significantly affected contractual agreement that implying the need for stable milk market to reduce the risk of spoilage in case demand for milk decreases. The study has also found that there was lack of formal institutions that govern

dairy marketing except the rules and regulations in the cooperatives associated with members of the cooperatives. Due to the lack and ineffective functioning of the formal institutions, informal institutions such as trust dominate the dairy marketing in the study area.

The study has indicated that there was lack and low level of involvement of formal institutions in the dairy marketing. The dairy marketing is done mostly in a traditional way of trading with highly dependence on trust and mutual understanding. How the interaction between the formal and informal institutions can be used to improve market transaction is a challenge that must be given great emphasis. In order to overcome the lack and ineffective functioning of the formal institutions in dairy marketing in the study area policy makers should focus on devising appropriate regulations, formal rules and principles to govern the dairy marketing in the study area. Government should intervene in dairy establishing cooperatives and large milk processor plants facilitate producers to supply their production using contractual agreement easily without any loss of milk.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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