



ISSN 2278 – 0211 (Online)

## Factors Affecting Smallholder Farmers' Participation in Dairy Contract: Evidence from Small Holder Farmers' of Walmara District

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### **Abstract:**

Milk production is one of the major income generating activities for smallholder dairy contract farmers in Ethiopia. Contracting farming has been introduced as solution to overcome barriers of entry to agribusiness industry by smallholder farmers, but certain measures need to be undertaken to ensure contract enforcement and to reduce transaction costs. The aim of the study was focused on the factors affecting dairy contract farmers in Walmara districts in Ethiopia based on the total survey of 180 farmers. Four stage sampling procedure is employed to select specific dairy producer households. Binary logit model was used to analyze the factors affecting dairy contract farming. The results indicated that the significant variables included in the model such as education of the household head, land holding size, Frequency of extension contact and distance to the nearest market were positively and significantly affect dairy contract farming in the study area. The study concludes that in order to increase participation in contract farming, there is need for dairy policy to consider existing knowledge, assets of the farmers and decentralize milk Collection Centers. Therefore, attention should be given to major factors that affect dairy technology adoption by livestock and fishery development office to increase production and productivity of the sector.

**Keywords:** Contract farming, logit model, smallholder, study area

### **1. Introduction**

Dairy production is an important component of livestock in Ethiopia. It is an important source of food, income and creates job opportunities for many people in rural and urban areas. However, despite its huge number, the performance of sub-sector in general is low compared to its potential and the direct contribution it makes to the national economy is limited (Sintayehu *et al.*, 2015). As market oriented production is expanding, it in turn strengthens the need for effective institutional arrangements. Smallholder farmers may face difficulties in fully participating in this market oriented approach. They might be marginalized as larger farmers become more important and influential. However, governments and development agencies try to empower these smallholders through developing different income generating farming activities for rural people.

Well-managed contract farming is an efficient way to coordinate and encourage production and marketing in agriculture. However, it is important to identify when contract farming is most appropriate. Depending on the type of product, buyer and the nature of market one can decide when contract farming is most suitable in agriculture (Birhanu *et al.*, 2013). The need for producers and buyers to coordinate in all stages of production is more significant for perishable products. Therefore, contract farming is used for high quality fruits, vegetables, flowers, and other quality sensitive and perishable commodities. Furthermore, in dairy and poultry production, contract farming is common because of perishability and the need for technically specialized and sophisticated inputs which are not easily obtained by producers.

The type of market also influences suitability of contract farming. If products need a constant quality on the final market contract farming is favored in order to control the production process (Birhanu *et al.*, 2013). That is why products for export markets often use contract farming arrangements. In general, international markets, particularly those in developed world, need products which comply with high quality and food safety standards. Therefore, contract farming is expected when such standards are very important and guarantee of the quality of the products is crucial.

Knowledge of how CFAs impact participants and of the factors that influence participation is important to policy-makers seeking ways of promoting broad-based economic growth in rural areas (Miyata *et al.*, 2014). Interventions intended to shape CFAs in ways that promote and sustain broad-based growth should be based on information that is reliable and relevant. Hence, the overarching goal of this study is to generate information about the factors affecting smallholder farmers' participation in dairy contract farming in the study area.

Therefore, this study is designed to assess the factors affecting smallholder farmers' participation in dairy contract farming in Walmara district. This is because factors affecting smallholder farmers' participation in dairy contract farming have not

been systematically studied and documented in the study area. Hence, this study is interested to fill the knowledge gap existed on the factors affecting smallholder farmers' participation in dairy contract farming in the study area.

**2. Methodology**

**2.1. Description of the Study Area**

The study was conducted in Walmara districts of West Shoa zone of Oromia region, Ethiopia. The study districts, Walmara district have a human population of 402,614 which is about 16.9% of the total human population of the Zone (CSA, 2012). The livelihood of the communities in the Zone including the study districts is based on mixed crop-livestock production system. The topography of the zone, which is mainly leveled field, makes it an ideal place for agriculture. Temperature ranges from 11-21 °C and rainfall from 880-1200 mm (Zonal diagnosis and intervention plan West Shoa, Oromia 2013).

**2.1.1. Research Design**

This study we used descriptive survey methodology using mean comparison and percentage tools were applied between the characteristics of contract participants and non-participants t-test for continuous variables and chi-square for dummy variables respectively. Four stage sampling procedure is employed to select specific dairy producer households. Then by employing Probability Proportional to Size (PPS) the number of farmers to be taken from each Kebele is determine at the third stage. Finally based on the sampling frame will collecting from each Kebele, Systematic Random Sampling is used at the fourth stage to select the sample dairy-producing farmers. The determination of sample size is resolved by means of Yamane (1967) sampling formula with 90 percent confidence level. Out of the total 10, 257 households, 180 households were selected using simple random sampling methods proportionally. The questionnaires were aimed at finding factors influencing participation in contract farming in Walmara districts. The research used both primary and secondary data. Primary data inform of qualitative or quantitative were obtained using questionnaires while secondary data were gathered from documented published books and journals.

**2.2. Econometrics Analysis**

To identifying the factors affecting smallholder farmers' participation in dairy contract farming at the individual household level, binary logit model was used. Therefore, the cumulative logistic probability model is econometrically specified as follows:

$$P_i = F(z_i) = F(\alpha + \sum \beta_i X_i) = \frac{1}{1 + e^{-z_i}} \dots\dots\dots 1$$

Where,  $P_i$  is the probability that an individual will participate in formal credit or does not participate given

$X_i$ ; e denotes the base of natural logarithms, which is approximately equal to 2.718;

$X_i$  represents the  $i^{th}$  explanatory variables; and  $\alpha$  and  $\beta_i$  are parameters to be estimated.

Logit model could be written in terms of the odds and log of odds, which enables one to understand the interpretation of the coefficients. The coefficient of the logit model therefore represents the change in the log of the odds associated with a change in the explanatory variables. The odds ratio implies the ratio of the probability ( $P_i$ ) that an individual would choose an alternative to the probability ( $1-P_i$ ) that he/she would not choose it.

$$1 - p_i = \frac{1}{1 + e^{z_i}} \dots\dots\dots 2$$

$$\frac{p_i}{1 - p_i} = \frac{e^{z_i}}{1 + e^{-z_i}} = e^{z_i} \dots\dots\dots 3$$

Or

Therefore, to get linearity, we take the natural logarithms of odds ratio equation (4), which results in the logit.

$$\ln\left(\frac{p_i}{1 - p_i}\right) = \ln\left(\frac{e^{z_i}}{1 + e^{-z_i}}\right) = \ln(e^{\alpha + \sum \beta_i X_i}) \dots\dots\dots 4$$

$$z_i = \ln\left(\frac{p_i}{1 - p_i}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots\dots + \beta_m X_m \dots\dots\dots 5$$

If the disturbance term ( $u_i$ ) is taken in to account, the logit model becomes

$$z_i = \alpha + \sum_{i=1}^m \beta_i X_i + u_i \dots\dots\dots 6$$

**2.2.1. Access to Dairy Contract Farming**

The dependent variable for binary logit is of dichotomous nature representing smallholder farmer's access to contract farming. This is to distinguish or discriminate between those who are participants of contract farming or not. It is a binary variable with 1 for yes and 0 otherwise. Contract farmer or non-users of contract farmer in the study area.

**2.3. Explanatory Variables of the Study**

**2.3.1. Age of the Farm Household Head (AGE)**

It is a continuous variable, defined as the farm household heads age at the time of interview measured in years. Those farmers having a higher age due to life experience will have much better association with cooperatives and other contract farmer institutions, and it is hypothesized that farmers with higher age may have more access to use contract

from the formal sources. Age of the household head is expected to affect smallholder farmers' participation in dairy market contract positively.

#### 2.3.1.1. Sex of Respondent (SEX)

This is a dummy variable that assumes a value of "1" if the head of the household is male and "0" otherwise. In mixed farming system, both male and female take part in dairy management. Female contributes more labour in areas of feeding, cleaning of bans and milking.

#### 2.3.1.2. Land Holding Size

It is a continuous independent variable measured in hectare. As input for dairy production, land is very important for forage and pasture development to feed dairy cows. It is expected that as size of land increases, proportion of land allocated for feed development and improvement increases.

#### 2.3.1.3. Education Level of the Household (EDUHH)

It is a dummy variable, represents the level of formal schooling completed by the household head at the time of the survey. Education enhances farmers' ability to perceive, interpret and respond to the new events. Therefore, in this study education was expected to positively affect. They have the ability to analyze costs and benefits.

#### 2.3.1.4. Frequency of Extension Contact (EXECON)

This refers to the number of contacts with extension agents that the respondent made in the month. Farmers who have a frequent contact with extension agents are expected to have more information that will influence farm household's demand for contract farming from the formal sources. Therefore, it will be hypothesized that this variable positively influences farmer's access to contract farmer.

#### 2.3.1.5. Access to Market Information (ACC MKT)

This is measured as a dummy independent variable taking a value of 1 if the farmer had access to market information and 0 otherwise. Household marketing decision is based on market price information. Poorly integrated markets may convey inaccurate price information leading to inefficient product movement. Study conducted by Miyata et al., 2014 on food marketing behavior showed that better market information significantly raised likelihood of market participation of households. Therefore, it will be hypothesized that this variable positively influences farmer's access to contract farmer.

#### 2.3.1.6. Membership of Farmer's Multipurpose Cooperatives (MEMCOOP)

This is a dummy variable, which takes a value "1" for membership and "0" otherwise. However, for other agricultural activities credit is provided for members only). Therefore, it is hypothesized that farmers who are members of cooperatives will not participating in contract farming. Therefore, it will be hypothesized that this variable negatively influences farmer's access to contract farmer.

#### 2.3.1.7. Dairy Farming Experience

It is a continuous independent variable measured in years of dairy farming. Households who have been in dairy production for many years are expected to have rich experiences regarding opportunities and challenges of milk production and marketing. Therefore, the variable is hypothesized to affect smallholder farmers' participation in dairy contract farming.

#### 2.3.1.8. Distance to Contracting Firms Milk Collection Center

It is a continuous variable and measured in hours which producers walk or travel to reach the nearest district market (contracting firm). The closer the household is located to the contracting firms market, the lesser would be the transportation cost, loss due to spoilage, better access to market information, and less time spent. Therefore, distance is hypothesized to affect smallholder farmers' participation in dairy contract farming positively.

#### 2.3.1.9. Farm Inputs

It is a dummy variable equals to 1 if the farmer has received external farm input support and 0 otherwise. It will be hypothesized to affect participation of contract farming positively because farmers have input support will produce more and hence participates and sell in large volume.

### **3. Results and Discussions**

The following table revealed that the sex distribution of sampled households. From total sampled households, 62.8 % of them were male and 37.2 % of them were female headed. With regard to participation status of the sample respondents on participation in dairy contract farming by sex, they found that 84.9 % of dairy contract participants were male household head while the rest 15.1% was female. Concerning of non-participant household heads, 25.5 % and 74.6% of the respondents were male and female respectively. The chi-square test analysis describes that there was no statistical significant differences in the sex of the respondent between dairy contract participant and non-participants at 5% significant level.

Variable	Measurement	Non-participant		Participant		$\chi^2$ -value	Total	
		N	%	N	%		N	%
Sex	Male	17	25.4	96	84.9	63.9***	113	62.8
	Female	50	74.6	17	15.1		67	37.2
	Total	67	100	113	100		180	100
Marital status	Single	6	8.96	6	5.31	1.17	12	6.67
	Married	44	65.67	73	64.60		117	65
	Separated	17	25.37	34	30.09		51	28.33
	Total	67	100	113	100		180	
Education	Literate	21	31.34	105	92.92	75.94***	126	70
	Illiterate	46	68.66	8	7.08		54	30
	Total	67	100	113	100		180	100
Membership of Any cooperative	Member	47	70.15	34	30.09	27.27***	81	45
	Not member	20	29.85	79	69.91		99	55
	Total	67	100	113	100		180	100

Table 1: Summary of Descriptive Statistical Results for Dummy (Categorical) Variables

Source: Computed from the Field Survey Data, 2019

The above table revealed that more than 70% of the respondent in the study area had formal education where as only 30% of those that has no formal education. From dairy contract participant household 92.92 % of dairy contract participants were literate household head while the rest 7.08% was illiterate. This indicates formal education in participant group was better (35.45%) than in non-participant (22.5%) groups. Moreover, the calculated chi-square value showed that there was statistically significant difference between participant and non-participant households with respect to membership of education level of households.

From the total sample households 45% of respondents were a member of any cooperatives in the study area. Whereas 55 % of respondents didn't participate on it. Majority (79%) of dairy contract participants respond that they are not participated in agricultural cooperatives while the rest (34%) of the respondents respond that they participate. Similarly, out of dairy contract farming non-participant respondents, only (47%) of them participated in agricultural cooperatives while the rest (20%) of them didn't participate. The Chi-square was employed to examine statistical significant difference between dairy contract participants and non-participants on participation of cooperative organizations. As indicated in Table 11, it was found that, there were significant 27.27 differences between dairy contract participant and non-participant in terms of participation at 1% level of significance.

### 3.1. Summary of Descriptive Statistical Result for Continuous Variables and T-Test

In this study, the total average physical market distance of sampled households away from large cities was 40.42min. The average market distances of participant and non-participant households away from town was (2.32min) and (44.03min) respectively. As indicated in Table 2, it was found that, there were significant 4.46 differences between dairy contract participant and non-participant in terms of participation at 1% level of significance.

Variable	Non-Participant		Participant		Total		T-test
	Mean	St.dev	Mean	St.dev	Mean	St.dev	
Distance from the market	44.03	5.72	2.32	0.87	40.42	8.79	4.46***
Total livestock in TLU	3.33	1.73	3.64	1.76	3.35	1.75	1.24**
Experience in contract farming	3.04	1.05	3.95	1.27	3.67	3.61	4.83***
Frequency of extension contact	1.5	1.09	2.32	0.87	2.05	1.03	4.82***

Table 2: Summary of Descriptive Statistical Result for Continuous Variables and T-Test

Source: Computed From the Field Survey Data, 2019

As indicated in above Table, both sample respondents in the study area have an average of (3.35) tropical livestock unit. The mean livestock unit of dairy contract participants was (3.64) while non-participants were (3.33). The statistical t-test (1.24) in the same table indicated that there was statistically significant mean difference between the two categories (dairy contract participant and non-participants) in terms of livestock owned statistically at 5% of level of significance. The total mean of experience of dairy contract farming of household was 3.61 per year. The result of t-test value shows that there was significant mean difference between participant and non-participants regarding to households' experience in dairy contract at 1% significance level.

Walmara district experts and different NGOs are who provide different extension services related with dairy production development at kebele level for rural households. They offered different training and supports to dairy contract participants, consult and motivate those who didn't accessed extension services the respective organization due to lack of information and awareness. A household who has access to dairy production extension service is more likely to go for technology adoption than those who has no access. Extension service widens the household's knowledge with regard to the use of improved dairy production technologies which leads to participate on more improved practices.

Despite variations of extension services, the district government and other stakeholders' were provided these services for small holder farmers to promote improved dairy technologies. Respondents were asked to respond on whether they contact with development agents in the last recent months or not. It is obvious that households who contact more with the development agents know more about the benefits of the extension services delivered by the agents. The average number of contact respondents made with the extension development agents in months was 2.05. The average number of contacts made by dairy contract participants was 2.32 while the average number of contacts made by non-participants was 1.5. This shows that, there was difference between the two categories in terms of number of contact made with the development agents.

### 3.2. Econometric Results

The results of the study indicate that contract farming factors that influenced participation in dairy contract farming was uncertainty related to price to participating farmers than their control counter parts because non contract farmers are more exposed to market dynamics than the contract farmers because milk prices change depending on prevailing market conditions.

### 3.3. Education Level of the Household (EDUHH)

The study findings in table, Education level of households was positively and significantly affected dairy contract farming at 5% significance level. As education in farming level increases participation in contract farming increases. Education is believed to give individuals with the necessary knowledge that can be used to collect information, interpret the information received, and make production and marketing decisions. This may be because decision to save requires some skill and training. Education tends to improve rationality and have good attitude about decision to save by considering the benefits which gained from saving diversified use of resources.

### 3.4. Frequency of Extension Contact

The result of logistic regression presented that Frequency of Extension Contact was positively affect the probability of household head dairy contract farming at 5% significance level. Access to dairy extension services such as dairy technology, information, training, field days, field visits and field tours received by households positively and significantly affected dairy contract farming. The marginal effect shows that the likelihood of accessing dairy contract farming increases by 16.64% as compared with accessing individual consumer milk market outlet for one more member access to dairy extension services.

Variables	Coefficient	dy/dx	Robust std.Error	Z	p>z
Age	-0.0042458	-0.000718	0.0330515	-0.13	0.898
Sex	0.688565	0.124298	0.529898	1.30	0.194
Education	3.930621	0.7043957	0.6411133	6.13	0.000***
Experience	0.262652	0.044416	0.1845186	1.42	0.155
Distance	-0.1194955	-0.020274	0.03704186	-3.23	0.001**
Land Area	0.8872175	0.1500338	0.2925688	3.03	0.002**
Credit	-0.9733324	-0.1483981	0.6631539	-1.47	0.142
Cooperative	-0.7341948	-0.1210055	0.5637498	-1.30	0.193
Freq Extn Contact	0.9839098	0.1663851	0.308951	3.18	0.001**
Mrt Information	-0.0950586	-0.0158769	0.647371	-0.15	0.883
Constant	-0.7981045	-	2.085187	-0.38	0.702

Table 3: Logistic Regression Model of Factors Affecting Households Dairy Contract Farming

Source: Computed From the Field Survey Data, 2019

Note: Dependent variables are Dairy Contract Farming.  $N=180$ ,  $prob> \chi^2 = 000$ ,  $PseudoR^2 = 0.53$ ,  $\log likelihood = -55.92$ , \*\*\* and \*\* means, statistically significant at 1% and 5% respectively, Std. Err is robust.

Source: Own computation from survey result, 2018

### 3.5. Landholding Size

Landholding size of households positively and significantly affected dairy contract farming at 5% significance level. The finding coincides with the findings of Staal et al. (2006). This indicates household who have more amount of land would have more amount of cows finally the probability of household head can participate in dairy contract farming was increased. The marginal effect further confirms that probability of household participate in dairy contract farming was increased by 15% as landholding of a household increases by a one hectare.

### 3.6. Distance to the Nearest Market

The result of logit model indicated that distance travelled by households from their home to dairy contract farming of was positively affect households' participation to contract farming at 1% significance. Distances to market was measured in time taken to reach the market. This was done to make estimation easy for the respondents. The variable therefore captures distance in time rather than inkilometers. The distance to the milk collection center, an indicator of cost of access to benefit from contract farming influenced participation in contract farming dairy farmers living farther from

the milk collection center are not more likely to participate in contract farming, one explain this by a consequence of having alternative and better local business places where dairy farmers can sell their produce and this affects participation and the quantity of milk supply to the milk collection centers(Amare, 2013).

#### 4. Conclusion and Recommendations

This study was aimed at analyzing Dairy contract farming in Walmara *District* of Oromia National regional State. The specific objectives of the study to identify factors affecting smallholder farmers' participation in dairy contract farming in the study area. Four stage sampling was used to select survey keble and respondents. Binary Logit model was applied to analyze factors affecting smallholder farmers' participation in dairy contract farming in the study area. Among 10 explanatory variables, which were hypothesized to affect households' participation in contract farming, the significant variables included in the model such as education of the household head, Distance to the nearest market, Landholding size of the farmers and frequency of extension contact were positively and significantly affect households' participation in contract farming. Therefore, this study recommends that education level of household and frequency of extension contact influenced participation in contract farming positively thus this study recommends that the dairy policy should base on existing strengths of the farmers and strengthen the current strategies of extension education, providing relevant knowledge that can be used to collect information and make production and marketing decisions, direct contact of extension workers with farmers increased as this can increase benefits of contract farming to beneficiaries hence participation in contract farming this can ensure the optimal realization of their livelihoods' potentials.

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