ORIGINAL ARTICLE

Determinants of participation decisions and level of participation in farm level milk value addition: The case of smallholder dairy farmers in Ethiopia

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ABSTRACT

On-farm value addition to farm products is recognized and highly promoted through value chain approaches for its benefit in terms of improving farm income. Growing demand and high price for value added milk products, together with the availability of ample livestock resources, would provide opportunities for smallholder farmers in Ethiopia to diversify their livelihoods. Nevertheless, their participation in milk value addition is perceived to be generally low. Apart from farm household characteristics, organizational and institutional issues influence farmers' participation decisions and level of participation in-farm level milk value addition. By analyzing survey data using Heckman two-stage selection model, this article identified determinants of participation decisions and level of participation in-farm level milk value addition by smallholder farmers in Ethiopia. The first-stage probit model estimation results indicate that milk yield, distance from urban centers, household demography (age and child), livestock extension services, the need to extend shelf life, consideration of milk products for social factors such as holidays and fasting, and availability of labor for milk value addition determined household's decision to add values to milk. The results also show that most of the factors determining decision of participation in milk value addition also determined the level of participation.

***Keywords*:** Determinants, milk value addition, participation decision, smallholder dairy farmers

INTRODUCTION

Value addition refers to the act of adding value(s) to a product to create form, place, and time utility which increase the customer value offered by a product or service. It is an innovation that enhances or improves an existing product or introduces new products or new product uses (Fleming, 2005). Income growth, urbanization, and technological advances, along with ever expanding global trade in agriculture, have contributed to a growing global demand for processed products with added values. The emerging trend for processed agricultural products in the global market creates opportunities for smallholder farmers in the developing countries to

benefit from such opportunities by linking their activities to value chains through vertical and horizontal linkages (Vermeulen *et al*., 2008). Yet, there are ample opportunities for smallholder farmers in the domestic markets for them to supply products with added values. Farmers add values to milk to get products such as butter, cottage cheese, skimmed milk and *aguat*-watery products from cottage cheese making. Milk provides a typical example with growing demand for milk value added products in Ethiopia. Given its ample livestock resources from milk production both in the pastoral, agro-pastoral, and mixed crop-livestock farming system areas, promoting on-farm value addition to milk products is believed to be useful for poverty reduction through creating income generating opportunities to the rural poor. In addition to serving as mechanisms in generating income, milk value added products are potential avenues to minimize losses and increase milk storage life, a unique opportunity due to strong local demand for such products. The basic patterns of milk value addition such as churning soured milk to make butter, dehydrating butter to make ghee and removing whey to butter to regulate milk fermentation are common practices in Ethiopia.

Milk value addition is labor intensive, female and children taking the largest share of the work as a domestic chore. Milk value addition through these methods is often considered inefficient and it is associated with 'losses' of up to 12% due to low rates of butterfat recovery (FAO, 2003). It is questionable, however, as to how real these losses are, since the buttermilk is used to make cottage cheese, a traditional soft cheese, which consumers prefer with the traditional fat resulting from the inefficient butter making. In the context of Ethiopia where market for raw milk is underdeveloped, especially in the rural areas, milk products with added values tend to fetch better income to farmers than the raw milk. Though contribution of milk value added products to the gross value of income generated from livestock production is not known, von Massow (1989) showed that the sale of milk value added products, especially butter and cottage cheese, provides 28% of the smallholder dairy farmers' income in Ethiopia.

From participatory research conducted prior in the study area, we observed that participation decisions and level of participation in farm level milk value addition vary across socio-economic and demographic characteristics of farm households and also in relation to factors associated to market access and institutional support services. Each dairy farmer is different in many aspects, including resource ownership, market orientation (commercialization), access to services, etc which contributes to different decision making behavior and participation level. Many studies conducted in the past characterized milk value added products of Ethiopia (Asfaw and Jabbar, 2008; Berhanu and Dirk, 2008; Kedija *et al*., 2008; Asfaw, 2009). Nevertheless, none of these past studies attempted to identify determinants of participation decisions and level of participation in farm level milk value addition in Ethiopia. The objective of this study is therefore to identify determinants of participation decisions and level of participation in farm level milk value addition.

Identifying such determinants help to inform subsequent interventions aimed at promoting commercialization of smallholder agriculture in Ethiopia. Apparently, determinants of institutional and economic nature could easily be approached to enhance on-farm level milk value addition as a means to promote income generation and reduce rural poverty. The results will be of interest to various actors in the smallholders' dairy sector, such as developing countries which intend to upgrade smallholder dairy value chain, consumers, governmental and nongovernmental organizations engaged in transforming smallholder dairy value chain in a pro-poor approach. In the next section, smallholder dairy farmer survey followed by the discussion of two-stage Heckman

sample selection model was described. In the last section, empirical results, discussion and conclusion are given.

METHODOLOGY

The study was conducted in *Damote Gale*, *Offa*, *Bolosso Sore*, *Sodo Zuria* districts and *Sodo* town of *Wolaita* zone, Ethiopia. The sample size was determined by ungrouped one stage random likelihood sampling method (Yamane, 1967). Then proportional sampling method was employed on the basis of dairying potential of the districts and town. The major advantage of this sampling method is that it guarantees representation of defined groups in the population. Hence, it improves precision of inferences made to the full population. The proportional shares of districts and town in sampled population are 25.8% in *Sodo* town, 25.1% in *Sodo zuria*, 24.8% in *Bolosso Sore*, 21.6% in *Damote Gale* and 2.5% in *Offa*. Within these districts, 33 *Kebeles* were identified on the basis of dairy production and marketing potential. Following this, a pilot survey was carried out on a group of randomly selected farmers to check suitability of designed questionnaire to the socioeconomic and cultural setups. A total of 398 randomly sampled dairy farmers were surveyed during summer 2010 using semi-structured questionnaire by trained interviewers. Four households with inappropriately filled questionnaire and missing data were dropped from further consideration. To analyze determinants of participation decisions and level of participation, data from 394 households were used. However, only 273 households added values to milk indicating that milk production is not necessarily for value addition, given a household demand for fluid milk consumption and fluid milk market access. Out of these households, 71% of farmers produced butter, 47.3% of farmers produced cottage cheese, 47.3% of farmers produced *aguat* and 9.9% of farmers produced skimmed milk. The specifications of the empirical models used to identify these determinants follows the selectivity model widely discussed in the participation literature (Gotez, 1992; Key *et al*., 2000; Heltberg and Trap, 2002; Holloway *et al*., 2004; Bellemare and Barrett, 2006). In selectivity models, the decision to participate can be seen as a sequential two-stage decision making process. In the first-stage, farmers make a discrete decision whether or not to participate in milk value addition. In the second-stage, conditional on their decision to add values to milk, farmers make continuous decision on the level of participation.

In the first-stage, we used the standard probit model, which follows random utility model and specified as Wooldridge (2002):

$$Y^* = Z'\alpha + \varepsilon_1$$
$$Y = 1 \; if \; Y^* > 0$$
$$Y = 0 \; if \; Y^* \leq 0 \qquad (1)$$

Where,

Y^* = latent (unobservable) variable representing farmers' discrete decision whether to add values to milk or not

Z' = vector of independent variables hypothesized to affect farmer's decision to add values to milk

α = vector of parameters to be estimated which measures the effects of explanatory variables on the farmer's decision

ε_1 = normally distributed disturbance with mean (0) and standard deviation of δ_1, and captures all unmeasured variables

Y = dependent variable which takes on the value of 1 if the farmers add values on milk and 0 otherwise.

Since the probit parameter estimate does not show by how much a particular variable increases or decreases the likelihood of adding values to milk, marginal effects of the independent variables on the probability of a farmer to add values to milk was considered. For continuous independent variables, the marginal effect is calculated by multiplying the coefficient estimate α by the standard probability density function by holding the other independent variables at their mean values. The marginal effects of dummy independent variables are analyzed by comparing the probabilities of that result when the dummy variables take their two different values while holding all other independent variables at their sample mean values (Wooldridge, 2002).

Finally, the log likelihood function which is maximized to obtain parameter estimates and corresponding marginal effects is given as:

$$Ln\ L\left(\frac{\alpha}{Y},\ Z\right) = \sum_{y=1} \ln(\Phi\,(Z'\,\alpha) + \sum_{y=0} \ln\,(1-\Phi(Z'\alpha) \qquad (2)$$

Conditional on participation decisions, the variables determining level of participation are modeled using the second-stage Heckman selection model (Heckman, 1979). The Heckman selection equation is specified as

$$\begin{aligned} Z_i* &= W_i'\alpha + \varepsilon_2 \\ Z_i &= Z_i* \ \ if\ \ Z_i* > 0 \\ Z_i &= 0 \ \ if\ \ Z_i* \le 0 \end{aligned} \qquad (3)$$

Where,

Z_i* = latent variable representing the desired or optimal level of milk value added which is observed if $Z_i* > 0$ and unobserved otherwise

Z_i = observed level of milk valued added

W_i = vector of covariates for unit i for selection equation which is a subset of Z'

α = vector of coefficients for selection equation

ε_2 = random disturbance for unit i for selection equation

One problem with the two equations (1 and 3) is that the two-stage decision making processes are not separable due to unmeasured farmer variables determining both the discrete and continuous decision thereby leading to the correlation between the errors of the equations. If the two errors are correlated, the estimated parameter values on the variables determining the level of participation is biased (Woodridge, 2002).

Thus we need to specify a model that corrects for selectivity bias while estimating the determinants of the level of participation. For this purpose, in the first-step, Mills ratio is created using predicted probability values obtained from the first-stage probit regression of the participation decisions. Then, in the second-step, we include the Mills ratio as one of the independent variables in the level of participation regression.

Thus, the level of participation equation with correction for sample selection bias becomes:

$$V = X'\beta + \lambda\left(\frac{\phi(X'\beta)}{\Phi(X'\beta)}\right) + \varepsilon_3 \quad (4)$$

Where,

$\phi(.)/\Phi(.)$ = Mills ratio

λ = coefficient on the Mills ratio

ϕ = standard normal probability density function

Φ = standard cumulative distribution function

ε_3 = not correlated with ε_1, ε_2 and other independent variables. Under the null hypothesis of no sample selection bias λ is not significantly different from zero.

V = level of participation (in liter)

In this study, the independent variables determining smallholder dairy farmers' milk value addition decisions and level of participation are derived from participatory research conducted in the study area. The dependent and exogenous variables, their definitions, and descriptive statistics (arithmetic means and standard deviations) are shown in Table 1. There is a competition between family requirement for fluid milk and the amount needed for value addition. Therefore households with child under age six are hypothesized to affect milk value addition decision and level of participation negatively. Aged household heads need fluid milk for normal lifestyle and thus hypothesized to affect milk value addition decision and level of participation negatively. Household heads who attended formal education have better information regarding value addition and markets and therefore hypothesized to affect milk value addition decision and level of participation positively. In Ethiopia, a number of holidays and fasting periods are respected with consumption of value added milk products and it is hypothesized that they affect milk value addition decision and level of participation positively. The quantity of milk yield per day is hypothesized to affect milk value addition decision and level of participation positively.

Many dairy breeds have been imported to Ethiopia through dairy improvement program of which Friesian and Jersey are the best adaptive breeds. However, smallholder farmers believed that milk from the breeds have low fat content. Therefore owning only local cows is hypothesized to affect milk value addition decision and level of participation positively. Value addition to milk in response to consumer quality preference is hypothesized to affect milk value addition decision and level of participation positively. If markets for liquid milk are readily available, only less than 10% of farmers add values to milk (Staal and Shapiro, 1996). Therefore, access to fluid milk markets is hypothesized to affect milk value addition decision and level of participation negatively.

Poor institutional support services such as livestock extension and market information are hypothesized to affect milk value addition decision and level of participation negatively. The perishable nature of milk and options to extend shelf life through value addition is hypothesized to affect milk value addition decision and level of participation positively. Milk value addition requires access to labor, mostly of women and children, and labor availability is hypothesized to affect milk value addition decision and level of participation positively.

RESULTS AND DISCUSSION

According to the survey results, 77% of the respondents participated in milk value addition (Table 1). The major milk value added products produced are butter, cottage cheese, skimmed milk and ghee. About 50.3% of respondents added values to milk always, 47.7% added values to milk sometimes and 2% added values to milk only during low demand or fasting time. Only

2.08 liters of milk, out of average 8 liters yield per day, was used for value addition. Average distance travelled by households to the nearest urban centers was 3.18km implying huge opportunity for milk value addition. Average level of education by household head was 6 years of formal schooling that indicates low awareness of household heads on value addition. Average age of household head was 44 years; dominated by younger heads that encourage milk value addition. Average number of children under six years of age was less than one.

Moreover, 63% of the respondents had no child, 23.4% had only one child and 13.6% had more than one child under the age of six years. Therefore, lower competition for fluid milk consumption by sampled households and thus higher opportunity for milk value addition.

Fifty eight percent of respondents owned only local cows. Thirty seven percent of respondents had available labor for milk value addition. This implies that in the absence of labor, households opt for selling or consuming fluid milk than adding values to milk. Thirty nine percent and seventy nine percent of the respondents had poor access to livestock extension and market information services, respectively. About 38% of the respondents believed that milk value addition extends shelf life. This indicates that majority of smallholder dairy farmers immediately sell and/or consume milk value added products to fulfill their household needs. Forty one percent of the respondents conducted milk value addition for social factors such as holidays and fasting. About 16% of the respondents carried milk value addition in response to consumer quality preference. This implies that on contrary to developed countries where value addition decision of firms is responsive to consumer preferences, smallholder dairy farmers do not worry about quality preference of consumers.

Table 1. Definition of variables and their descriptive statistics

Variable definition	Variable name	Mean (SD)
Milk value addition decision (1=Yes, 0=No)	ADD	0.77(±0.021)
Level of participation (liter)	AMOUNT	2.08(±0.313)
Milk yield per day (liter)	YIELD	7.87(±0.963)
Distance to the nearest urban center (Km)	DIST	3.18(±0.218)
Education level of farmer head in years	EDU	5.73(±0.284)
Age of farmer head in years	AGE	44.13(±0.533)
Number of children aged under six years	CHILD	0.55(±0.043)
Poor access to livestock extension services (1=Yes, 0=No)	EXT	0.39(±0.025)
Poor access to market information (1=Yes, 0=No)	INFOR	0.79(±0.021)
Value addition extends shelf life (1=Yes, 0=N0)	SHELF	0.38(±0.025)
Milk products are important for holidays (1=Yes, 0=No)	HOLIDAY	0.41(±0.025)
Value addition is in response to consumer quality preference (1=Yes, 0=No)	DEMAND	0.16(±0.018)
Types of dairy cow owned (1= owned only local cows, 0 otherwise)	TYPES	0.58(±0.025)
Availability of labor for value addition (1=Yes, 0=No)	LABOR	0.37(±0.024)

US$ 1 = Birr 13.632 during summer 2010, results in parenthesis are standard deviations.

Results of first-stage probit model estimation of the determinants of the probabilities of the household to add values to milk are given in Table 2. The Table also contains the values of marginal effects which are evaluated at the means of all other independent variables. The overall goodness of fit for the probit model parameter estimates is assessed based

on several criteria. First, the log likelihood ratio test is applied to assess the overall joint significance of the independent variables in explaining the variations in the dairy farmers' likelihood to add values to milk. The null hypothesis for the log likelihood ratio test is that all coefficients are jointly zero. The model chi-square tests applying appropriate degrees of freedom indicate that the overall goodness of fit of the probit model is statistically significant at a probability of less than 1%. This shows that jointly the independent variables included in the probit model regression explain the variations in the farmers' probability to add values to milk. Second, the McFadden's Pseudo R^2 is calculated and the obtained values indicate that the independent variables included in the regression explain significant proportion of the variations in the dairy farmers' likelihood to add values to milk. The probit model explains 77% of the variations in the likelihood of dairy farmers to add values to milk. Third, the probit model predicts about 99% of the cases correctly.

As expected, age of household head is negatively associated with farmer's likelihood to add values to milk and statistically significant at less than 10% significant level. As household head's age increases by a year, the probability that household adds values to milk decreases by $4.97x10^{-2}$%. On contrary to prior expectation, education level of household head is negatively associated with dairy farmer's likelihood to add values to milk but not statistically significant. On contrary to prior expectation, milk yield per day is negatively associated and statistically significant with farmer's likelihood to add values to milk. As milk yield per day increases by a liter, the probability of adding values to milk decreases by $2.02x10^{-2}$%. The reason behind this is that smallholder dairy farmers believe that milk from exotic breeds may reduce adding values due to low fat content and milk production from local breeds can also increase with high fat content. One implication is that crossbred cows are preferred where the ultimate objective is to sell fluid milk. The other implication is that any intervention deemed to upgrade dairy value chain among smallholder farmers should consider the potential of local cows in providing value added products. On contrary to prior expectation, the number of child under six years is positively associated with farmer's likelihood to add values to milk. The result shows that the probability of adding values to milk increases by 1.38% for households who do not have a child under age six. The implication is that smallholder dairy farmers can also participate in milk value addition without much of the problem related with child number.

As expected, distance to the nearest urban center is statistically significant and positively associated with farmer's likelihood to add values to milk. This indicates that as farmer's distance from the nearest urban center increases by a km, farmer's likelihood to add values to milk increases by $8.27x10^{-1}$%. This may be due to perishable nature of milk, transportation cost, etc associated with accessing urban markets. As expected, poor access to livestock extension services is negatively associated with farmer's likelihood to add values to milk. This indicates that poor access to livestock extension services decreases the probability of adding values to milk by 2.342%. Poor access to market information services is negatively associated with farmer's likelihood to add values to milk but statistically insignificant. The need to extend shelf life of milk through value addition is positively associated with farmer's likelihood to add values to milk. As the number of households who need to extend shelf life increases by a member, the probability of adding values to milk increases by 4.191%. As prior expectation, consideration of value added milk products for social factors such as holidays and fasting by household is positively associated with farmer's likelihood to add values to milk. The probability of adding values to milk increases by 3.797% for households who consider milk value addition for social factors.

Contrary to prior expectation, smallholder dairy farmers add values to milk in response to consume demand in terms of quality preference is negatively associated with the decision to add values to milk but statistically insignificant. On contrary to developed countries where milk value

addition is in response to consumer preference, smallholder dairy farmers do not worry about consumer quality preferences when making decision to add values to milk. A type of cows owned by smallholder dairy farmers is positively association with farmer's decision to add values to milk but statistically not significant. Availability of labor for milk value addition is positively association with household's decision to add values to milk and the effect is statistically significant at a probability of less than 5%. This indicates that the probability of adding values to milk increases by 7.129% for farmers who have available labor. Farmers who do not have available labor reported that they sell fluid milk than add values

Table 2. First-stage probit estimation results of determinants of probability of milk value addition

Symbol	Coefficient	Marginal effect $\frac{\partial P(Y=1/X)}{\partial X}$	P>/z/
Constant	0.276(0.57)	-	0.283
YIELD	-0.008(0.003)	$-2.02\times10^{-4}(1.456\times10^{4})$	0.022***
DIST	0.326(0.068)	$8.27\times10^{-3}(5.89\times10^{-3})$	0.000***
EDU	-0.03(0.02)	$-7.71\times10^{-4}(8.61\times10^{-4})$	0.138
AGE	-0.019(0.01)	$-4.97\times10^{-4}(4.584\times10^{-4})$	0.059*
CHILD	0.545(0.168)	$1.38\times10^{-2}(1.078\times10^{-2})$	0.001***
EXT	-0.706(0.246)	$-2.342\times10^{-2}(1.879\times10^{-2})$	0.004***
INFOR	-0.163(0.241)	$-3.704\times10^{-3}(5.594\times10^{-3})$	0.500
SHELF	1.64(0.408)	$4.191\times10^{-2}(2.579\times10^{-2})$	0.000***
HOLIDAY	1.433(0.359)	$3.797\times 10^{-2}(2.597\times10^{-2})$	0.000***
DEMAND	-1.011(0.589)	$-2.735\times10^{-4}(1.525\times 10^{-2})$	0.986
TYPES	0.264(0.238)	$7.087\times10^{-3}(9.688\times10^{-3})$	0.269
LABOR	2.365(0.458)	$7.129\times10^{-2}(3.04910^{-2})$	0.000**
	Number of observations = 394; Wald $chi^2(12) = 68.46$;		
	Log pseudo likelihood = -74. 38(0.000)***; Pseudo R^2 = 0.65;		
	Observed probability 0.77; Predicted probability 0.99		

The dependent variable is a dummy variable that takes on the value 1 if the farmer had added values on milk, 0 otherwise. Figures in parenthesis are robust standard errors. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

The results of second-stage Heckman selection estimation for the level of participation are given in Table 3. The coefficient of Mills ratio (Lamda) in the Heckman two-stage estimation is significant at the probability of less than 1%. This indicates sample selection bias, existence of some unobservable farmer characteristics determining farmer's likelihood to add values to milk and thereby affecting the level of participation. The overall joint goodness of fit for the Heckman selection model parameter estimates is assessed based on the log likelihood ratio test. The null hypothesis for the log likelihood ratio test is that all coefficients are jointly zero. The model chi-square tests applying appropriate degrees of freedom indicate that the overall goodness of fit for the Heckman selection model is statistically significant at a probability of less than 1%. This shows that jointly the independent variables included in the selection model regression explain the level of participation.

Milk yield per day is negatively related and statistically significant with the level of participation. This indicates that ceteris paribus, an increase in milk yield per day by a liter results in 9.82×10^{-5} decrease in the level of participation because high milk yield from exotic breeds may decrease the involvement of farmers in value addition. Distance to the nearest urban center is positively associated and statistically significant with the level of participation. This implies that holding other explanatory variables constant, a km away from urban center results in 0.179 liter increase in level of

participation. Contrary to prior expectation, the number of children under age six in a household is positively associated and statistically significant with the level of participation. By keeping other independent variables constant, absence of a child under the age of six in one additional respondent's household results in 0.44 liter increase in level of participation. Respondents responded that when they are sure of giving birth to a child, they look for milking cow in order to feed a child and lactating mother. Excess fluid milk left over from child and mother is used to add values to nourish the mother.

Table 3. Results of second-stage Heckman selection estimation of determinants of level of participation

Symbol	Coefficient	P>|z|
Constant	-0.103(0.482)	0.831
YIELD	$-9.82x10^{-5}(4.6x10^{-3})$	0.02***
DIST	0.179 (0.032)	0.000***
EDU	$-1.9x10^{-3}(0.015)$	0.899
AGE	$-1.19x10^{-2}(0.0085)$	0.164
CHILD	0.444(0.124)	0.000***
EXT	-0.250(0.179)	0.164
INFOR	-0.325(0.202)	0.107
SHELF	0.337(0.224)	0.132
HOLIDAY	0.719(0.224)	0.001***
DEMAND	0.648(0.296)	0.029**
TYPES	0.365(0.182)	0.045**
LABOR	0.759(0.180)	0.000***
LAMDA	-0.149(0.180)	0.007***
	Number of observations = 394	
	Censored observations = 121	
	Uncensored observations = 273	
	Wald $chi^2(12)$ = 144.46(0.000)***	
	Rho = -0.94872	
	Sigma = 0.1578	

The dependent variable is the quantity of milk value added. Figures in parenthesis show Heckman two- stage standard error. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Consideration of value added milk products for social factors such as holidays and fasting is positively and statistically associated with level of participation. Ceteris paribus, consideration of milk value added products for social factors by one additional respondent household result in 0.719 increases in level of participation. Milk value addition in response to consumer quality preference is positively associated and statistically significant. While keeping other explanatory variables constant, an addition of a respondent household who add values to milk in response to consumer quality preference results in 0.648 increases in the level of participation. A type of cow owned and availability of labor for value addition are positively associated and statistically significant with the level of participation and the effects are statistically significant at a probability of less than 5%. Holding other explanatory variables constant, addition of a household owning only local milking cow and who has available labor for milk value addition result in 0.37 and 0.76 liter increase in level of participation, respectively.

In conclusion, determinants of smallholder dairy farmers' milk value addition decisions and level of participation was analyzed using Heckman two-stage selection model. The findings revealed that milk yield per day, distance from urban center, household demography (age and children), livestock extension services, the need to extend shelf life, consideration of milk products for social factors such as holidays and fasting, and availability of labor for milk value addition determined household's decision to add values to milk. The results also show that most of the factors determining participation decision in milk value addition also determined the level of participation.

The findings have important policy implications because these value addition behaviors of farmers would seem to continue to play a vital role in dairy value chain. It is important to understand these determinants of value addition for the benefit of the poor farmers. Information generated help all dairy value chain actors aiming to upgrade dairy production and support policy analysis and policy making. Therefore, dairy value chain policies that would consider determinants of smallholder dairy farmers' value addition decisions and the level of participation to improve their performance, including quality control is likely to serve the interests of all dairy value chain actors.

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