MILK PRODUCTION AND MARKETING IN SMALL DAIRY HOLDERS IN THE NORTHERN AREA OF VIETNAM: A CASE STUDY IN PHU DONG, VIETNAM

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SUMMARY

Dairy cows in small holders in Phu Dong contribute to improve the welfare of farm households. It generates income, provides a highly nutritious food for people, create employment opportunities in the society. However, most dairy farmers have a few cows, which will be difficult to improve their lives. They are more vulnerable because milk is easy to be rotten, feed costs are high and increasing; market is fluctuated with shock while gate farm price is almost stable. This study analyzes the situation of milk production and marketing in small holders in Phu Dong. The Heckman two-step procedure is used to estimate factors affecting the decision of market participation and milk marketed volume of dairy households. The main findings are: The pure HF breed dairy cows produced higher productivity but shorter lactation period than that of cross breed cows. The productivity was highest in the pure HF breed medium-size farms and lowest in the cross breed medium-size farms. However, there is not much difference in milk yield per lactation between these breeds. Age of the household, education level, experience in dairy production, distance from milk market and number of milking cows significant impact the probability of the household in milk market participation. Number of milking cows, education level of the households, and non-dairy source financial incomes are important factors affecting sale volume of milk.

Key words: milk production, milk marketing, market participation, milk yield.

1. INTRODUCTION

The potential advantage of dairy in small holders in Vietnam is improving the welfare of farm households. It generates income for them, which can be used for different purposes, e.g. purchases of goods for household consumption, school fees and medical expenses, or productive investment in other farm or non-farm sectors. Milk from dairy production provides a highly nutritious food for people of all age groups and particularly for infants and lactating mothers thus reducing the problem of malnutrition among rural households. The value adding activities such as the processing, marketing and distribution of milk and milk products create employment opportunities in the society. It is argued that in situations where the arable land is shrinking and where there is high population density, the dairy farming may be one of the few agricultural activities that can support viable smallholder farming (Asfaw Negassa, 2007). In general, there are also several other functions attached to the dairy farming production such as manure production, store of wealth, risk mitigation and display of social status (Asfaw Negassa, 2007).

This paper studies on the situation of milk production and marketing in small holders in Phu Dong commune. Milk production focuses mainly on milk productivity, milk yield, lactation period of pure Holstein Friesian (HF) and cross breed in different farm sizes. Then socio-economic characteristics of the market participating and non-participating dairy households will be analyzed such as: age and education level of household head, family size, experience in dairy production, income from non-dairy source, distance from market, numbers of dairy cow, etc. The research uses the Heckman two-step procedure to estimate which factors affecting the decision of market participation and milk marketed volume of dairy households.

Research objectives

- Assess the current situation of milk production and marketing in small holders in Phu Dong, Gia Lam, Ha Noi, Vietnam

- Identify factors affecting the decision for milk market participation and milk marketed volume in the study area.

2. METHODS

2.1 Selection of the study site

This research chooses Phu Dong as a study site because: (i) farmers in Phu Dong have a quite long time experience in dairy production; (ii) dairy is one of the key economic sectors, bring the major source of income for farmers in Phu Dong; (iii) quantity and quality of milk in Phu Dong are increasing quickly nowadays with total livestock populations are 1300; 800 of that are giving milk; (iv) milk production and marketing in Phu Dong have to cope with challenges.

2.2 Method of Sampling

Forty (40) dairy households, accounts for 5.7% total dairy households[1], are selected based on milk production potential and the presence of various dairy marketing actors who contributes to value addition of the dairy commodities in the area. Farms owning 1-3, 4-6 and greater than six dairy cows were classified as small, medium and large farms, respectively. In this area, almost dairy households got less than six cows. Thus, based on the breed type and number of dairy cows, the farms which owned pure HF and cross breed cows in each of the farm size categories were identified. The result of this assessment indicated that there was a very small number of both pure HF and cross breed large dairy farms across the study area and few numbers of medium pure HF dairy farms in Phu Dong. Therefore, these dairy farms were not considered for further data collection.

Total 40 sampled households were divided into categories in terms of size and breed as pure HF breed - small size (LBSZ), pure HF breed – medium size (LBMZ), cross breed – small size (CBSZ), and cross breed – medium size (CBMZ) as follows:

Table 1 Dairy farm by sample location

	Dairy farm type by size			
	Pure HF breed cows		*Cross breed cows*	
	Small size	*Medium size*	*Small size*	*Medium size*
Number of farms	9	2	20	9
Average farm size	2.6	5	2.4	5

2.3 Econometric analysis

If a data set that is used for a regression suffers from selectivity bias, then the regression analysis, for example, Ordinary Least Squares (OLS), which computes the effects of some characteristics of this population on other characteristics, will be biased. Heckman has developed a two-step procedure that corrects for sample selectivity bias. If two decisions are involved, participation and volume of supply in milk market, two-step procedure is appropriate. The first stage of the Heckman two-stage model is a "participation equation", attempts to capture factors affecting participation decision. This equation is used to construct a selectivity term known as the "inverse Mills ratio" (which is added to the second stage "outcome equation" that explains factors affecting volume of milk supply. The inverse Mill's ratio is a variable for controlling bias due to sample selection. The second stage involves including the Mills ratio for the milk supply equation and estimating the equation using Ordinary Least Square (OLS). If the coefficient of the "selectivity" term is significant, then the hypothesis that an unobserved selection process governs the participation equation is confirmed. Moreover, with the inclusion of an extra term, the coefficient in the second-stage selectivity corrected equation is unbiased. Specification of the Heckman two-step procedure is written in terms of the probability of milk market participation (MMP), and marketed milk volume (WMS).

[1] According to Salvatore and Reagle (2002), a random sample size (n) is satisfied if it is at least equal to 5% of the population size (N) and the number of observations is at least equal to 30 ($n \geq 30$).

The participation equation:

$Y_{1i} = \chi_{1i}\beta_1 + u_{1i}$ $\quad u_{1i} \sim N(0,1)$

MMP = 1 if $Y_{1i} > 0$

MMP = 0 if $Y_{1i} \leq 0$

Where Y_{1i} is the latent dependent variable which is not observed.

χ_{1i} is the vectors that are assumed to affect the probability of dairy household milk market participation.

β_1 is vectors of unknown parameter in participation equation.

u_{1i} are residuals that are independently and normally distributed with zero mean and constant variance.

The observation equation/ the milk marketed equation:

WMS $= Y_{2i} = \chi_{2i}\beta_2 + u_{2i}$ $\quad u_{2i} \sim N(0,\delta^2)$

Y_{2i} is observed if and only if MMP = 1. The variance of u_{1i} is normalized to one because only MMP, not Y_{1i} is observed. The error terms, u_{1i} and u_{2i}, are assumed to be bivariate, normally distributed with a correlation coefficient, ρ; β_1 and β_2 are the parameter vectors.

Table 2 Descriptions of the dependent and independent variables used in the model

Variables	Description	Types	Values
SMP	Size of milk output	Continuous	Kilogram
NC	Number of milking cows	Continuous	Head cow
AGE	Age of household head	Continuous	Number of years
SMP	Size of Milk Produced	Continuous	Kilogram
FSHH	Family size of household	Continuous	Man equivalent
ELHH	Education level of household	Continuous	Years of schooling
EXHH	Experience in dairy production	Continuous	Number of years
DNMM	Distrance from dairy market	Continuous	Kilometer
NC	Number of Dairy Cows	Continuous	Number of dairy cow
MMV	Marketed Milk Volume	Continuous	Kilogram
ACEXT	Access to extension service	Dummy	0=not visited, 1= visited
INFDS	Income from non-dairy sources	Continuous	VND
SEX	Sex of the household head	Dummy	0=female, 1 =male
ACCR	Access to credit	Dummy	0=no, 1=yes
ACMINF	Access to milk market information	Dummy	0=no, 1=yes
MMP	Milk market participation	Dummy	0=no, 1=yes

3. RESULT AND DISCUSSION

3.1 Milk production

3.1.1 Productivity of dairy cattle

The independent samples t-statistics indicated that there was strong and statistically significant difference between cross breed milking cows on their mean milk yields per day. The average milk yield per day of a pure HF breed dairy cow (20.7 kg) seems to be higher than that of a cross breed dairy cow (19.8 kg). However, the percentage of marketed milk per a cross breed (80.4%) is higher than a pure HF breed dairy cow (75%). This is the amount of milk that was sold to collectors according to farmers' contracts with milk processing company. The other 19.6% and 25% respectively, were auto consume and sold in an informal market.

Table 3 Productivity of dairy cattle by breed and the household market participation

Items	Pure HF breed dairy cows	Cross breed dairy cows	t-value
Mean milk produce per day (kg)	20.7	19.8	-5.97
Mean milk sold per day (kg)	15.52	15.92	
% of milk marketed in formal market	75	80.4	

Source: survey result, 2012.

The share of milk sold was high within a cross breed dairy farms mainly due to their larger production base and more market-oriented production objectives. The share of pure HF breed dairy farms in milk market participation was found to be small in terms of quantity. The mean milk production per day per a dairy cow during the survey period was found to be the highest (21.25 kilograms) in LBMZ and lowest (19.39 kilograms) in CBMZ dairy farms.

Table 4 Productivity of dairy cattle by farm size and percentage of dairy household participated in the milk market

Items	Dairy farm types				F-value
	LBSZ	*LBMZ*	*CBSZ*	*CBMZ*	
Mean milk yield (kilograms)	20.61	21.25	20.03	19.39	15.32
Percentage of households participate in milk market	88.9	100	80	88.9	

Source: survey result, 2012.

The survey results indicated that 88.9%, 100%, 80% and 88.9% of sampled LBSZ, LBMZ, CBSZ, CBMZ dairy owners were, respectively found to participate in a milk market. The other dairy household doesn't participate in the milk market because of the next dry period of their cows. The F-test statistics revealed that the mean difference in milk produced and sold per dairy households was estimated to be statistically significant at less than 1% probability level.

3.1.2. Milk yield and lactation of dairy cows

The mean lactation period of dairy cow was 276.35 days for pure HF breed dairy cows and 296.65 days for cross breed dairy cows. The average milking days of a cow for LBSZ and LBMZ farm groups was 285.2 and 267.5 days, respectively, whereas a cow in CBLZ and CBMZ farm had almost the same lactation period. In general, the average lactation period for a pure HF breed cow was found to be lower than that of a cross breed. This is because the medium-size dairy farm owners seemed to be more market oriented and therefore, they were more economical. Moreover, the average milk production per annum of LBSZ, LBMZ, CBSZ and CBMZ farms are 5,875; 5,684; 5,915; 5,778 kg, respectively. There are not much differences in milk yield per lactation between these breeds because a breed that has lower average milk yield has longer lactation period and in reverse.

Table 5 Milk production and lactation

	Productivity and milking days of dairy farms							
	LBSZ		LBMZ		CBSZ		CBMZ	
	Lactation period	Ave. milk yield	Lactation period	Ave. milk yield	Lactation period	Ave. milk yield	Lactation period	Ave. milk yield
Average	285.2	20.6	267.5	21.25	295.3	20.03	298	19.39
Average milk produced per annum (tonnes)	5.875		5.684		5.915		5.778	

Average lactation period in terms of breed	276.35	296.65
Average milk yield period in terms of breed	20.925	19.71

Source: survey result, 2012.

3.2 Market participation of dairy household

3.2.1 Socio-economic characteristics of the market participating and non-participating dairy households

The mean family size of milk market participating household was larger than the non-participating households. The t-test statistics for the family size of the market participants and non-participants was found to be significant at less than 1% probability level. Farm households with larger family size in the adult equivalent had higher marketable milk than those with smaller family size. The mean experience years in dairy production of milk market participants and non-participants was 12.3 and 3.4, respectively and the average difference was estimated to be significant at 5% probability level. These indicate that family size in adult equivalent and experience can directly influence dairy household milk market participation.

The average numbers of cross breed milking cows owned by participating and non-participating sampled household were 3.17 and 0.5, respectively and were found to be significant at less than 1% probability level. Whereas, the mean number of pure HF breed milking cow owned by participating and no participating dairy household was estimated to be 3 and 0.33 milking cow per dairy household, respectively and the mean difference was estimated to be statistically significant at less than 1% significance level. Mean milk yield per day for participating and non-participating dairy household was 20.1 and 1.4 kilograms, respectively and was found to be significantly different at less than 1% probability level.

There is statistically significant difference in mean value of financial income from non-dairy source between participating and non-participating sampled dairy households and was estimated to be significant at less than 1% significance level. Non-participating dairy household had income from non-dairy source (24.1 million VND) is 3 times higher than participating dairy household (8 million VND).

Table 6 Socio-economic characteristics of milk market participants and non-participants

Variable	**Unit**	**Mean value of variable for**		**t-value**
		Participants	*No participants*	
Age	Years old	43.36	49.4	-0.52
Education level	Years	8.64	6.35	2.348
Family size	Person	4.18	5.4	-1.922
Experience in dairy production	Years	12.3	3.4	2.952
Number of cross breed milking cow owned	Heads	2.5	0.5	-12.37
Number of pure HF breed milking cow owned	Heads	1.17	0.33	7.945
Quantity of milk produced per day	Kilograms	20.1	1.4	-7.638
Income from non-dairy source per annum	VND	8,000,000	24,100,000	2.329

Source: survey result, 2012.

The survey result also revealed that dairy producers had access to a variety of market information sources. Forty-five percent (45%) of the total sampled dairy households had access to current milk market price information. Performance of dairy household also depends on access to market. Milk being a perishable commodity, good access to market is of paramount importance. The

information on average distance to milk market centers was analyzed as an indicator of access to market. The results revealed that 100% of sampled dairy households in the milk shed had easy access to milk market centers. Most of them use a motorbike as a transportation vehicle.

3.2.2 Milk marketing channels

Dairy milk in the study area was marketed through both formal and informal marketing channels. There were different types of milk marketing channels.

Table 7 Major milk marketing channels of the study area

The major milk marketing channels	**Proportion**
1. Producer → Consumer	1%
2. Producer → Retailer → Consumer	1%
3. Producer → Collector → Retailer → Consumer	8%
4. Producer → Collector → Company → Retailer → Consumer	90%
Total	100%

Source: survey result, 2012.

The two first channels account for only 2% of total milk marketed in Phu Dong. These channels were found to be the shortest channels identified during the survey period. The next one was identified to be operating in Hanoi where milk was marketed to milk collectors then retailers and go to consumers. This channel represents 8% of entire milk marketed in Phu Dong. The final is the major and the most important channel, which accounts for 90% of total milk marketed. This was the case because this channel can absorb a large amount of surplus milk in the region while the local demand for milk is much less than supply.

3.3 Factors Affecting Milk Market Volume

The study used the variance inflation factor to check multicollinearity among continuous variables and contingency coefficient to check multicollinearity among discrete variables. According to the test results, multicollinearity was not a serious problem both among the continuous and discrete variables between size of daily milk output and number of milking cows. As a result, the volume of daily milk production per household variable was not considered for the model analysis.

3.3.1 The binary probit equation/ participation Equation

The model output reports result of estimation of variables that are expected to determine milk market participation of each individual household. From all sampled dairy households, 86.66% were correctly predicted into market participant and non-participant categories by the model. The correctly predicted participants and correctly predicted non participants of the model were 90% and 76.66%, respectively.

Table 8 Estimation result of the Binary probit model

Variables	**Coefficient**	**t-ratio**	**Marginal effect**
Constant	-0.64	-1.83	
AGE	0.20749	1.72***	0.164
FSHH	0.16	1.65	0.101
ELHH	0.11	2.019**	0.059
EXHH	-0.042	-2.14**	-0.069
DNMM	-0.0168	0.069*	0.15
NC	0.6	2.41*	0.102
ACEXT	0.055	0.786	0.13
SEX	-0.29	-0.613	-0.02

ACCR	0.27	0.344	0.0025
ACMINFOE	0.59	1.51	0.055
INFNDS	-0.156	-0.702	-0.009

Dependent variable = household market participation (MMP), number of observation (N) = 40, Log likelihood function = -29.74, Restricted log likelihoods = -67.480, significance level=0.0000000,*,** and *** represents significance level at 1%, 5% and 10% probability level, respectively, positive prediction value =90.000%.

Source: survey result, 2012.

Out of 12 explanatory variables, five variables were found to determine the probability of milk market participation. They are: age (AGE), education level (ELHH), experience in dairy production (EXHH), access to milk market (DNMM) and number of milking cows (NC).

Age of the household head (AGE)

The age of the household head had a positive and significant impact on market participation decision of the sampled dairy households. The positive and significant relationship between two variables indicates that older dairy household head could have more milking cows increasing the probability of the household milk market entry decision. The marginal effect also confirms that when the household age increases by one year, the probability of participating in the milk market increases by 16.4%.

Education level of the household head (ELHH)

Education has a positive effect on probability of dairy household milk market participation decision and is significant at less than 5% probability level. The positive and significant relationship indicates that education improves the dairy household capacity to process production-related and market-related information, which in turn improves bargaining position. The marginal effect indicates that addition of one-year formal schooling leads the probability of dairy household milk market participation to rise by about 6%.

Experience in dairy production (EXHH)

Contrary to normal understanding, this variable has a negative impact on dairy household milk market participation decision and was significant at 5% probability level. The dairy households having longer experience in dairy production seemed to observe many bad impacts of fluctuation of the dairy cow during last decade[2]. The marginal effect of the variable also confirms that every one-year experience rise in dairy production causes milk market participation decision to fall by 6.9%.

Number of milking cows (NC)

This variable has positive relationship with household milk market participation decision and was statistically significant at 1% probability level. The positive and significant relation between the variables indicates that as the number of milking cow increases, milk production per dairy household also increases which in turn increases percentage share of sale volume of milk. The marginal effect of the variable confirms that increase in one head of dairy milking cow leads a rise in the probability of dairy household milk market participation by 0.2%. Moreover, this result designates that increasing number of dairy cows is an important policy relevant variable in stimulating the smallholder to market entry and benefit from economic transaction.

Distance to the nearest milk market (DNMM)

This variable has a negative effect on milk market participation and found to be statistically significant at less than 1 % significance level. The negative relationship indicates that the further is a household from the milk market, the more difficult and costly it would be to get involved in the milk market. The marginal effect implies that a one-kilometer increase in a milk market distance from the dairy farm owner reduces the probability of participation in milk market by

[2] Situation of failure in dairy program, melamine crisis, etc.

15%. In other words, as the dairy household becomes closer to milk market center by one kilometer, the probability of his or her participation in milk market rises by 15%.

3.3.2 Estimation Results of the Selection Equation

In the selection equation of the model, three variables are found to be significant determinants of level of milk market participation. They are: number of milking cows (NC), education level of the dairy household head (ELHH), and income from non-dairy source (INFDS).

Table 9 Dairy marketed milk volume equation model

Variables	Coefficient	t-ratio	Marginal effect
Constant	-2.93	-0.722	
AGE	0.73	0.033	0.73
FSHH	0.509	1.85	0.509
ELHH	0.401	0.802*	0.401
EXHH	0.0613	0.884	0.0613
NC	4.16	9.12*	4.16
ACEXT	0.33	1.41	0.33
SEX	-1.48	-0.932	-1.48
ACCR	-0.184	-0.091	-0.184
ACMINFOE	1.04	0.69	1.04
INFNDS	0.0001	1.93***	0.0001
LAMBDA	1.43	1.381	1.1701

Dependent variable = total milk supplied to market, Mean=7.37, number of observation (N) = 40, standard deviation=10.29, Model size parameter=13, R-squared=0.755966, Adjusred R-square=73, Log likelihood=-368.1751, Restricted (b=0) = -453.535, correlation of disturbance in regression and selection criteria = 0.029, significance level=0.0000,* and *** represents significance level at 1% and 10% probability level, respectively.

Source: survey result, 2012.

Education level of the dairy household head (ELHH)

Education has a positive effect on milk sale volume per household and is statistically significant at less than 5% probability level. The model confirms that one formal year education leads the dairy household to a rise in daily milk sale volume by 0.401 kilograms per day per household.

Income from non-dairy source (INFDS)

Financial income from non-dairy sources has a positive effect on sale volume and found to be significant at 10% probability level. The positive relation between the variables indicates that any additional financial income enables the dairy household to purchase more improved dairy cows or more feed for dairy cows, which can contribute to increased milk production and then contribute to increased milk market participation decision by dairy household.

Number of cows (NC)

This variable is significant at 1% probability level and has a positive effect on marketable milk volume. The model output predicts that the addition of one milking cow leads to an increase in the marketable milk surplus of the dairy household by 4.16 kilograms per day per dairy household. This result is plausible and suggests that marketable milk surplus of the household in the study areas are more responsive to number of milk cows. Furthermore, this result elaborates that marketable milk surplus per day increases in response to the increase in milking cow number.

LAMBDA

According to the model output, the Lambda (Inverse Mills Ratio) or selectivity bias correction factor has a positive, but statistically insignificant impact on dairy household marketable milk

surplus. This result suggests that there appears to be no unobserved factors that might affect both the probability of dairy household market entry decision and the marketable milk volume.

4. CONCLUSIONS AND IMPLICATIONS

There is only fresh milk are available for sale in dairy householders in the study area. The average milk produced by pure HF breed is higher than that of cross breed cows. However, the lactation of cross breed is longer than that of pure HF one. The mean milk production per day per a dairy cow was found to be the highest in pure HF breed medium-size farms and lowest in cross breed medium-size farms. There are not much differences in milk yield per lactation between these breeds because a breed that has lower average milk yield has longer lactation period and in reverse. There is a need to expand the capacity of the existing milk production system in small holders to procure and market increasing volume of milk.

Market participation decision and sale volume are found to be important elements in the study of milk marketing of the study area. Age of the household, education level, experience in dairy production, distance from milk market and number of milking cow owned were found to exert a significant impact on probability of the household milk market participation. And the number of milking cows, education level of the households, and non-dairy source financial income as important factors affecting sale volume of milk. The models predict that the addition of one milking cow leads to a rise in marketable surplus by about 4.16 kilograms per day and an increase in probability of household milk market participation.

Distance from a milk market has a positive impact on marketable milk volume; however, it has a negative and significant impact on dairy household market entry decision. Turning to the knowledge accumulation variables of the study, education has a significant impact on milk market entry decision; however, education has an important but insignificant impact on sale volume.

The survey result identified that milk were found to be marketed through different marketing channels that were being identified during the survey period. The most important marketing type was formal marketing. Dairy collectors are responsible for buying milk from small holders and deliver to milk processing company. The marketing system for milk was predominantly traditional and fragmented, and characterized by no licensing requirements to generate the operation. Generally, dairy marketing system in the area was characterized by under developed and inefficient type of market.

In order to increase milk market participation and milk marketed volume, all efforts should be made to strengthen the capacity of existing small and medium-scale farmers who show a potential to enlarge their herd (enough land, interest, technical know-how). Small holders should, whenever possible, be encouraged into interest groups in order to increase market participation. The organizational approach should be addressed step by step (primarily by forming interest groups or clubs rather than cooperatives). Active exchange of experiences should be promoted by study tours to private farms and existing interest groups to improve milk quantity production.

Moreover, financial and market access seems to be very important factors. Thus, the local and national government could pay more attention to enhance their access to financial investment and market access. The dairy farmers also should be encouraged to improve their financial capacity to improve the herd quality and quantity for further development.

Reference

1. Heckman, James (1979). "Sample Selection Bias as a Specification Error", *Econometrica*, Vol 47, No 1., January, pp. 153-161.
2. Tran Huu Cuong, Bui Thi Nga (2011), “Actor benefit’s analysis on value chain of fresh milk in Vietnam”*, Economics and Development*, Issues 169 II, July, p32-38.
3. Bui Thi Nga, Tran Huu Cuong, Philippe Lebailly (2011), “An analysis of the value chain of fresh milk in the North of Vietnam (Case study in Sonla province)”, *Vietnam Socio-Economic Development,* No 68, December, p35-50.

4. Bogdan K. (2008), *Dairy sustainable development: From production to consumption*, Presentation at the Workshop on Strategy for Vietnam Dairy Industry: Discuss the public and private roles, Hanoi.
5. Nancy B. et al (2006), *Review, analysis and dissemination of experiences in dairy production in Vietnam*, AVSF/ACI/FAO final report.
6. Nancy M. (2008), "FAO vision for the Dairy Development in Asia", *Conference on Dairy Strategy in Vietnam, Hanoi, 30-31/10/2008.*
7. IFCN (2006), *The economics of milk production in Hanoi, Vietnam,* with particular Emphasis on Small scale Producers, PPLPI working paper No. 33 http://www.ifcnnetwork.org/media/pdf/DR10-Extract-lowres.pdf, consulted 20/09/2009
8. Patrice Gautier (2008), *Smallholder Dairy in Vietnam,* Study and Presentation on behalf of FAO within the project "Improved Market Access and Smallholder dairy farmer Participation for Sustainable Dairy Development" (CFC/FIGMDP/16FT)