ORIGINAL ARTICLE

Economics of Smallholder Dairy Production and Gender Roles in Dale District of Sidama Zone, Southern Ethiopia

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ABSTRACT

This research was aimed at analyzing production efficiency and profitability of local dairy farm, assessing gender roles in dairy production, , and identifying challenges to dairy farm. The study used gross margin and breakeven point analysis and multiple regression methods to analyze profitability of smallholder dairy farm and the Cobb-Douglas production function to analyze farm level production efficiency. The survey result revealed that 90% of husband and 46% of wives received formal education. The major cost in dairy production was feed cost, accounted for 76% of the dairy production. For the same level of education, household headed by female could produce more (58%) milk than household headed by male (46%). About 68% of the total work load in dairying was carried out by female. Total revenue and gross margin per annum per dairy cow was Birr 9080 and Birr 6415, respectively. Multiple regression analysis revealed that gender, number of milking cow and lactation period variables were statistically significant, whereas number of livestock possessed, distance from extension service, experience and access to credit were statistically insignificant. The production function analysis also revealed that green and dry fodder and number of milking cow variables were statistically significant. However, labor and concentrate were statistically insignificant. As result, the study suggests that the smallholder dairy enterprise is a viable venture and could play an important role in enhancing household income. Thus, it is recommended that the government, donors and other service providers need to allocate more resources towards smallholder dairy development on general and in the areas of knowledge transfer in particular with special focus of women.

Key word: Dairy, profit, cost, gender, economic

INTRODUCTION

Livestock is vital to the economies of Ethiopia in providing protein for human diets, income, employment and foreign exchange. For low income producers, livestock can serve as a store of wealth, draught power, fuel, prestige and organic fertilizer for crop production and a means of transport (IGAD, 2008). In livestock sector, cattle population account for 69.5%, from which female and milking cow respectively accounts for 55% and 20%. According to MoFED and MoA (2011) and FAOSTAT (2013), from the total of 10.67 million milking cow, 2. 94 million tons of milk is produced per annum in Ethiopia.

However, Ethiopia, regardless of its largest dairy cattle population, is not among the four largest milk producing countries (Egypt, Kenya, South Africa and Sudan) (FAO, 2010). Although milk production in Ethiopia tended to increase during the last two decades at national level, the per capita milk consumption has decreased from 26 liters per annum in 1980 to 22 liters in 1993, 19 liters in 2000, 16 liters in 2009 and 19 liters in 2013. With total domestic consumption of 893, 699 tons of milk, Ethiopia remains to be the lowest compared to total domestic milk consumption of 2, 212, 323 tons in Kenya and 2, 753, 129 tons in Sudan (FAOSTAT, 2013). Moreover, Ethiopia has remained to be net importer of dairy products with import values significantly exceeding export values.

The three regions (Oromia, Amhara and Southern Nations and Nationalities and People's Region) put together, account for 89.94 percent of the total cattle population and 89.55 percent of the total number of milking cows in Ethiopia (Yilma et al., 2011). In Southern Nations, Nationalities and People's Regional State (SNNPRS) in particular, the total number of cattle population, milking and the share of milking cow to total cattle population is 10, 543,000, 2, 076, 000 and 19.7%, respectively. With average productivity of 1.65 liter per day per cow, the total annul milk yield in SNNPRS is 667, 562 tons (CSA, 2010a), from which 88.6% is consumed at home, 2.29% is sold, 0.36 is paid in kind for wage and 8.73% is processed into other dairy derivates (CSA, 2010b). However, according to SNNPRS's BoA (2014), the total number of dairy cow is 4, 943, 854, from which 933,225 tons of milk is produced per annum.

Similar to other part of Ethiopia, in SNNPRS in general and in Dale district in particular, economic return from scarce resources in smallholder dairy production remained to be insignificant for long. This has been due to combined effect of genetic limitation, inadequate and poor animal feed resources, limited physical and economic access to improved dairy cow/heifer, high **cost** of quality feed, absence of **sound** operational breeding policy and strategy, lack of farm data recording, poor artificial insemination service, weak linkages between research, extension service providers and technology users, high prevalence of disease, inadequate extension and training service, limited availability of credit to the dairy farmer:, limited pasture land, mismatch between demand and supply (Yilam et al., 2011). Several scholars estimated the production costs and profitability of the smallholder dairy in different parts of the world including Ethiopia Study by Dayanandan (2011) on production efficiency of dairy farm in high land of Ethiopia indicated that the share of variable and fixed cost of smallholder dairy farm was 90% and 10%, respectively. On the other hand, Ergano and Nurfeta (2006) reported that feed cost alone accounted for 80% of total cost. However, Nyekanyeka (2012) reported that variable cost alone accounted for 42%.Study by Dayanandan (2011) estimated that net return from local breed milk cow per year was estimated at Birr 2,619 with respective benefit-cost ratio of 2.18. Study conducted in Kenya by Stella (2011) on productivity trends and performance of dairy farming indicated that cost of concentrate form the largest cost component in smallholder none zero grazing system. The same study showed that the value of total variable cost, gross margin and variable cost per liter was Birr 803, 347 and Birr 2.2, respectively. Despite its positive contribution, dairying was reported to generate negative net benefit. For instance, study by Staal et al. (2003) conducted in Kiambu, Nakuru and Nyandarua districtst of Kenya showed that negative overall profit in smallholder dairying.

In general, dairying is labour intensive and gender sensitive. However, social definitions of dairy tasks carried out by men or women

varies from one society, region, class or ethnic group to another depending on their social and economic status within the household setting (Akililu, 2014). This variability indicates that the division of labor is determined not by the physical differences between sexes, but by the social definitions of proper relationship between women and men (Joseph, 2014). Women contribute in producing income from livestock, alone and in partnership with male family members. In Africa and Asian countries, male headed household make greater contribution than female headed households. But the reverse is true in Latin America countries (FAO, 2011).

From the Ethiopia perspective, dairy production activities are shared among household members. Head or elder women perform most of the routine and laborious livestock management activities such as looking after young animal and milking cow, milking cow in particular, processing milk and dairy products and managing income from dairy products. For instance, study by Abebe and Galmessa(2011) indicated that the share of women in milking, milk processing and feeding was 75%, 65% and 65%, respectively. However, Nyekanyaka (2012) reported that women in Malawi provide 70% of dairy labour force.

Though smallholder dairy production improvement is already underway in Ethiopia, the return to smallholder dairy scarce farm resources remains to be low. This means that choices have to be made about where, when, how much and how to deploy these scarce resources. Economic analysis provides a scientific and systematic method for making these choices (Zweifel*et al*., 2009).Research by Skunmun and Chantalakhana (2000) in Thailand; Mumba (2012) in Zambia; Nyekanyeka (2012) in Malawi and Dayanandan (2011) in Ethiopia conducted on economics of dairy farm , but using diverse approach. However, research based information on economics of small smallholder dairy farm and gender role is lacking in Ethiopia in general and in study area in particular. To this effect, there is a need to understand the economics of current smallholder production systems before making definite recommendations. The findings from this study therefore is believed to provide baseline data for policy makers, donors, development planners and farmers when making decisions related to the profitability of

smallholder dairy enterprises in the country in general.

Hence, this study was aimed at analyzing profitability of smallholder dairy farm, assessing gender role in dairy production and marketing, analyzing dairy farm production efficiency and identifying challenges to dairy farm in Dale district of Sidama Zone, Southern Ethiopia.

MATERIALS AND METODS

Description of the Study Areas

The study was conducted in Dale district of Sidama Zone, Southern Ethiopia. The area is located along the high way of Addis Ababa-Moyale Road at about 315 km from the capital of the country, and 45 km away from Hawassa City, the capital of Southern Nations, Nationality and People' Regional Sate (SNNPRS).

Sampling procedure and sample size

In this study, to determine sample size, different factors such as research cost, time, human resource, accessibility and availability of transport facilities were taken into consideration. In order to draw a total of 120 dairy households, the study used a multi-stage sampling procedure. The first stage involved purposive selection of the peasant association (PA) based on dairy production potential. In the second stage, from the list of dairy producers in the PA, those who had their cows in milk for the last 12 months were identified by using stratified sampling techniques. In the third stage, sample size was distributed between the two PAs' by using proportional sampling procedure. In the fourth stage, a simple random sampling technique was used to draw a total of 120 small dairy holders having at least one milking cow..

Data Collection

Both primary and secondary data were used in survey. Primary data were collected through a structured questionnaire, a checklist and a monitoring survey. Structured questionnaires were administered to 120 sampled dairy household. Primary data such as household characteristics, quantity of variable inputs used, cost per each variable inputs, fixed cost incurred in dairy production, value of dairy products, appreciation and depreciation values accounted during the year, income generated from other sources. Personal observation to confirm the

validity of data collected was used. Secondary data from secondary sources were collected meanwhile.

Data Analysis Method

Both descriptive and econometric analysis method were used to analyze the collected data.

Descriptive Analysis

Economic analysis at the farm level was based on gross margin in evaluating the economic performance of the dairy farms. In this study, gross margin analysis method was used to calculate profits from dairying at an individual farm level. This technique was used because it is the simplest and most practical method in assessing enterprise profitability and is widely used in farm management economics (Mumba, 2012).

The gross margin is defined as the difference between the gross value generated from dairy farm per year and variable cost incurred in production and marketing process. Chindime (2007) applied the gross margin analysis to estimate returns from smallholder dairy in in central and northern milk shed areas of Malawi. Somda*et al.* (2005) also used the gross margin analysis techniques to analyzed the economic viability of milk production in smallholder farming systems in Gambia.

According to Ted (2012), the following formula was used to calculate the gross margin was

$$GM = GR - VC$$

Where, GM is gross margin per cow; GR is gross revenue per year per cow and VC is variable costs associated with dairy production and marketing per cow per year.

The break-even point analysis (BEA) help to overcome the fixed nature of prices and outputs problem associated with using gross margin. The break-even milk yield was computed based on total fixed cost per milk cow per year and the differences between selling price per litter and variable cost per liter of milk. The following formula was employed to compute this:

$$\text{BEQ} == \frac{\text{TC}}{\text{PU} - \text{VC}}$$

Where,

BEQ is the break even milk yield;

TC is total fixed;

PU is price per unit of milk; and

VC is variable cost incurred during production and marketing process. The variable cost per liter was obtained from average variable cost

divided by average milk yield of a cow.

The Econometric Method

Multiple regressions analysis of socio-economic factors affecting profitability of smallholder dairy farm. The empirical analysis by Olubiyo et al. (2009) investigated the relationship between socio-economic variables and dairy farm profitability by using multiple regression methods. Other study by Nchund and Mendi (2008); Otietno et al.(2009) and Chagnda et al. (2006) analyzed the effect of age, gender, marital status, education level, household size and distance on relative profitability of smallholder dairy enterprises by using multiple regression method. In similar fashion, Mumba (2012) used multiple regressions method to analyze the relationship between annual gross margin and socio-economic variables such as age, sex, education, marital status, number of milking cow, experience, number of livestock, lactation period, access to credit, household size, and distance from milk collection center in small holder dairy farm in Zambia.

The implicit model of the regression analysis was:

$$GM = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + e$$

Where,

GM = is *the annual gross margin in Birr*;

B_0=The intercept;

$B_1 \ldots . B_7$ =The coefficients of the regression analysis;

X_1=Gender of the household head (dummy, female=0; male=1)

X_2=Number of milking cow (continues, measured in number)

X_3=Experience of the farmer (continuous, measured in years

X_4=Number of livestock (continues, measured in number)

X_5 =Lactation period (continues, measured in days)

X_6=Distance from extension service center (continues, measured in kilometer)

X_7 =Aaccess to dairy credit (dummy, 0=if no access, otherwise=1)

e = Is the error term assumed to be independent and normally distributed with zero mean and constant variance.

The Cobb-Douglas production function model: The model was fitted to data collected from sampled dairy farms, represented in the following mathematical equation:

$Y(x_1, x_2, x_3, x_4, x_5, x_6)$

$= b_0 x_1^{b1} x_2^{b2} x_3^{b} x_4^{b4} x_5^{b5} e^{u}$

However, as this function is power function, it was transformed into linear form by taking the logarithm of the "Y" and "x_i"values as follows:

$\log Y = \log b_0 + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_6 \log x_6 + e$

Y= total production (the monetary value of milk produced per year)

b_0 = Intercept

x_1=Number of milking cow per farm

x_2 = Human labour measured in days (8 hr per day)

x_3 =Concentrate fed to milk cow

x_4 = Dry fodder fed to milk cow

x_5 = Green fodder fed to milk cow

'b_0'' is a constant term, whereas$b_1, b_2 \ldots b_5$ are partial regression coefficients of Y with respect to $x_1, x_2 \ldots x_5$ variables and e^u is the random variable assumed to follow normal distribution with zero mean and constant variance.

The return to scale was estimated directly by getting the sum of the ' b_i coefficients. If the sum of b_i is greater than one, less than one and equal to one, the return to scale is said to be increasing, decreasing and constant, respectively.

Variable Definition and Measurements

Value of milk output: is dependent variable which represents the value of whole milk produced over a period of one year (number of lactation days)

concentrate: is independent variable fed to dairy cow during the study year. It was calculated on the base of buying cost of Birr 300/100kg or Birr 3/kg of concentrate.

Green fodder: includes succulent grasses, stem and leave of banana and *Ensete-ventricosum*, sugar cane stem, and green cereals. It is independent variable calculated on the base of buying cost of Birr 30 per quintal over lactation period.

Dry fodder: Dry fodder included hay, straw of barley, wheat and teff as well as maize stalk. This variable was used as independent variable and valued at purchasing cost of 40 Birr per quintal over a year time

Labor: labour was divided into: labour that goes to female and male headed household in dairy production. The wage rate per day for male was used as there was no formal wage rate for female in the study area. The sources for labour in both female and male headed households were family and hired labour. The paid (hired) labour was computed based on daily (8 hrs per day) wage rate of Birr 50 multiplied by average lactation period of 243 days. For unpaid

family labour, the average wage rate (Birr 50 per 8 hrs) for a qualified full-time worker in the micro area was used as opportunity cost.

Tale 1. Demograph. ic characteristics of dairy household

Variables	Husband (%)	Wife (%)
Education level	10	54
1-4	26	26
5-8	36	16
9-12	26	4
Total	100	100
Age (years)		%
20-30		6
31-40		32
41-60		60
Above 60		2

Source: own computation, 2014

RESULT AND DISCUSSION

Demographic Characteristics of the Respondents

It is apparent that education is vital in enabling one to adopt a new technology with better return. This is because it is proved that educated farmers are more able to interpret, make informed decisions and apply technical advice from research allowing them to accurately assess the relative benefits and risks from using alternative technologies (Omiti et al., 1999).

Education level for sampled respondents ranged from illiterate (zero schooling years) to secondary education (9-12 schooling years).However, in spite of this facts and their major responsibility in dairy production and marketing, less number (46%) of wives received formal education. Moreover, majority (42%) of them attended lower grade compared to their husband counterpart. It was only 4% of wives attended secondary level (9-12 schooling years) of education. On the contrary, 26% of the male counterpart attended secondary level of education (Table 1).

Majority (60%) of sampled household aged between 31-40 years followed by age between 31-40, accounting 32%. This indicates that dairying needs active labour age. The respondents aged between 20-30 and above 60 accounted for 6% and 2%, respectively. This implies that dairying is labour and capital intensive economic activities.

Relationship between Gender and Education Level in Milk Yield

Milk yield per week varied depending on the level of education the household head received and sex of the head. Female headed household could produce more milk even at literacy level (Table 2). This implies that female is more efficient in dairying than male given the resources and other facilities. For education level 1-4, 5-8 and 9-12 schooling years, female headed and male headed dairy household could produce 1.77, 1.9 and 1.65 and 1.53, 1.53 and 0.6 liters, respectively. In the same token, the share of female headed household was 54%, 55%, and 73% for schooling years 1-4, 5-8 and 9-12, respectively. In conclusion, from the total milk production per day per household, the share of milk produced by female and male headed household was respectively 58% and 42%.

Table 2. The relationship between gender and education in milk yield

Years of schooling	Milk yield/FHH/ day (liter) (n=95)	Milk yield/MHH/per day (Lit) (n=25)
Non-educated	1.34	1.`2
1-4	1.77	1.53
5-8	1.9	1.53
9-12	1.65	0.6
Above 12	Na	Na
Over all share (%)	58%	42%

Source: Own computation, 2014. na means no data for schooling years above 12, FHH is female headed household and MHH is male headed household.

Labour Division in Dairy Farm

The most important source of labour in dairy production and marketing was family. Labour division in dairying varied depending on the type of activities to be undertaken. Majority (62%) of the respondents' indicated that cow feeding was the responsibility of wife. However, 30% of the respondents indicated that milk cow feeding was the responsibility of both husband and wife. Hundred percent of respondents however, reported that cow milking; milk

processing, dairy product marketing and cow barn clearing activities were the sole responsibility of wife. It was only 10% of respondents reported that milk allocation was done by both husband and wife in consensus, while the remaining 90% of the respondents indicated that milk allocation among all alternatives was done solely by wife even without the consent of husband. According to table 3, 10%, 60% and 30% of the respondents respectively reported that managing income from dairy was handled by husband, wife and both wife and husband, respectively. On the other hand, 100% of respondents indicated that selling live dairy animal and feed purchase and transport was handled by husband (table 3). In overall, 24%, 68% and 8% of dairy labour load goes to husband, female and both female and husband, respectively.

Table 3. Labour division in dairy farm

Main dairy production and marketing activities	Responsibility (%)		
	Husband	Wife	Both
Cow feeding	8	62	30
milking	0	100	0
barn cleaning	0	100	0
milk processing,	0	100	0
milk allocation	0	90	10
Dairy product marketing	0	100	0
Managing income from dairy	10	60	30
Selling dairy animals	100	0	0
feed purchase and transport	100	0	0
Overall (%)	24	68	8

Source: own computation, 2014

Dairy Farm Productivity by Season

The survey result indicated that the proportion of milk cow to cattle population was 25%. This is in disagreement with report by FAOSTAT (2013). The report indicated that the proportion of milking cow to total cattle population was 20% According to survey data,

the average lactation period was 288 days over which 444 liters of milk was produced. According to sample respondents and group discussion made during the survey number of milking cow, breed (productivity) of dairy cow, quality and quantity of feed were reported to affect milk volume per dairy farm over lactation period, given other factors.

The volume of milk produced per day per dairy farm ranged from 0.25 liter in dry season to 11 liters in wet season. The proportion of dairy farm producing 1 liter per day during wet and dry season was respectively 34% and 38%. However, the proportion of dairy farm producing 1.5 liters dropped to 16% and 10%, respectively during wet and dry season. on the other hand, farm producing 2 liters per day rose to 26% and 12% in wet and dry seasons, respectively. Furthermore, households producing 3 and above 3 liters of milk dropped to zero in dry season. However, about 16% of the the sampled household could produce 3-11 liters per day during wet season. (Table 4). This implies that dairy production in rain fed agriculture is highly seasonal and feed and water sensitive.

As far as average milk yield per day is concerned, milk yield produced in wet season (1.98 liter) was found to be 2 times higher than milk produced in dry season (0.98 liter). This was averaged to be 1.53 liter per day for a lactation period.. This result is in closer agreement with report by Asaminew and Eyassu (2009), reported 1.53 liter average milk per day. However, it is in disagreement with Lando 'O Lake (2010) and CSA (2005), reported average milk yield per lactation period to be 1.23 and 1.22 liter per day per local cow, respectively.

Table 4. Dairy farm productivity by season

Level of milk (liter)	**% of household producing milk during**

	Wet season	Dry season
0.25	-	4
0.5	8	36
1.00	34	38
1.50	16	10
2.00	26	12
3.00	2	0
3.51	2	0
4.00	10	0
11.00	2	0

Average lactation period (days)	288
Average milk yield per day (lit)	1.5
Average cattle owned (no)	4
Average milking cow possessed (no)	1
% of milk cow to dairy cattle population	25
Total milk per lactation period (288 days)	444

Source: own computation, 2014

Milk utilization pattern

Figure 1 presents pattern of milk and milk byproducts utilization in Dale district of Sidama Zone, Southern Ethiopia. Sample respondents indicated that milk yield produced per dairy farm varied depending on number and productivity of dairy cow and season when milk is produced. Further, the respondents indicated that in turn, potential productivity of dairy cow is also reported to be affected by the extent to which milk cow is fed and managed. Once milk is produced and volume per day is known, the allocation among alternatives within family varied depending on the level of demand for liquidity, cultural practice whether to sell whole milk or process it, and age of household head. Wholemilk is consumed at if the head is aged above 50, and sold if the household is very closer to town. In general, soured butter milk was the major dairy commodity produced, consumed and marketed in the area. It is not customary to see a household producing cottage cheese because of long lived cultural practice.

Figure 1 illustrates whole milk allocation pattern with in dairy household. The major part (78%) of whole milk produced was converted

into yogurt (ergo). The remaining 22% was distributed among calf, home consumption and market. Accordingly, milk consumed at, consumed by calf and sold was respectively 21.26%, 1.1% and 0.5%. From the total of milk converted into ergo, 95% was churned into butter through which soured butter milk and butter were produced. The remaining 4.5% and 0.5% of ergo was sold and consumed at home, respectively.

According to informal discussion made with key informants, every 10 liters of whole milk fermented into ergo could yield other 10 liters of soured butter milk and a kg of butter. In this process, a women usually add at least one liter of pure water into soured butter milk after collecting her butter if she is to sell it.

According to figure 1, out of the total of butter and soured butter milk produced, 90% was marketed in both cases with remaining 10% consumed at home. However, soured butter milk retailed at spot market in village or Yirgalem town. . . Butter be table or cosmetic was sold at village level to individual consumer or at market places to assemblers, consumers or form of manure serves as a means to reduce total cost in crop retailers. Report by Zegeye (2003) and Lemma et al. (2005) is in agreement with this report.

According to respondents, there was no formal marketing channel for milk and milk byproducts in the study area. Dairy farm owners as a result sell their milk and milk products informally to vendors or village consumers. Few producers located to near to Yirgalem were found to deliver their milk to tea and coffee houses at Yirgalem town.

The share of Dairy in the Household Income

Table 5 below discusses the possible income sources for dairy household. Income from dairy, crop and non-agricultural activities accounted for 35.4% (Birr 9, 080.6), 52.91% (Birr 13, 367) and 11.14% (Birr 2,815.3), respectively. The major share (29.3%) of income belonged to dairy product Value of manure, dairy animal sale and appreciation in dairy animal (calf and heifer) respectively accounted for 2.64%, 2.98% and 1.05%. Moreover, along its use as source of income and nutrition for family, dairying in the

production as it serves as substitute for chemical fertilizer by the amount equivalent to Birr 667.9(table 5). This implies that dairying is an integral part for sustainable farming as it qualifies soil for crop production.

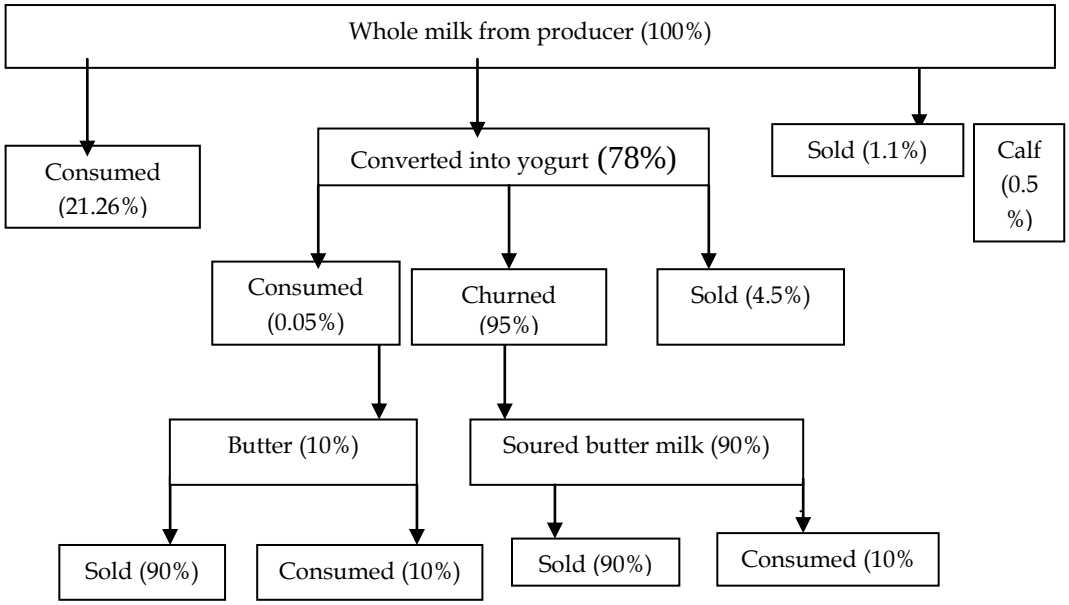

Figure 1. Milk Utilization Pattern

Table 5.Possible income source for dairy household per year

Variable	Mean	Share (%)
Dairy products sale(Birr)	7393	29.3
Value of manure (Fertilizer cost saved) (Birr)	666.9	2.64
Dairy animal sale (Birr)	754.3	2.98
Appreciation in heifer and calf	266.4	1.05
Average total value from dairy /year (Birr)	9, 080.6	35.4
Grain, fruits &vegetable sale (Birr)	13367	52.91
Non-agricultural products sale (Birr)	2815.3	11.14
Total HHs income (Birr)/year	25, 262.9	100

Source: Own computation, 2014

Cost Estimation

The two costs considered during the survey were both fixed and variable costs. Variable fixed costs respectively accounted for 88.2% and 11.8%. Labour, feed, medicament and Artificial Insemination (AI) costs were the major variable cost among which feed cost accounted for the largest share (76%).Labour, AI and

medicament costs accounted for 6.87, 3.4% and 1.8%, respectively. Interest rate on capital (6.08%) and depreciation cost of dairy cow (5.7%) were the two components of fixed cost (table 6). The report on depreciation cost, interest rate on capital asset and medicament is in agreement with findings by Dayanandan (2011) who reported these costs to be 5%, 4% and 1% of the total cost, respectively.Ergano and Nurfeta (2006) and Nyekanyka (2012) reported that feed cost and total variable costs accounted for 80% and 42%, respectively. . This indicates that improving feed quality and access element must receive attention from development concerned entities. .

Table 6. Cost Estimation

Cost items (Eth Birr)	**Mean ±SD**	**% share**
Labor	207.62±122.95	6.87
Cost for AI	103.32±45.4	3.4
Cost for feed	2299. 4±169.86	76
Cost for medicament	54.47±54.8	1.8
Total variable cost	2664.81±1801.8	88.07
Interest rate on capital	183.68±99.65	6.08
Depreciation cost	173±102.46	5.7
Total fixed cost	356.68±150	11.8
Total cost	3021.49±1918.3	100

Source: own computation, 2014

Profitability Analysis of Dairy Production

Amount of profit from dairying is subject to volume of milk produced and type of milk byproducts produced and marketed. According to survey result, 1.5 liters of whole milk per day or 432 liters of milk per annum (288 days) was produced per local dairy farm. The selling price for whole milk, soured butter milk and butter was Birr 10, Birr 6 and Birr 130, respectively. Accordingly, the total income (Birr 9,080)) was computed by multiplying quantity of output sold and consumed by unit price. In this regard, processed dairy products (butter and soured butter milk) could generate 70.5% (Birr 6, 403). When income from processed dairy products is compared with that of whole milk, processed dairy products

generated nearly 2 times higher income.

Table7 . Analysis of margin, cost-benefit and break-even point per local milking cow

Parameters		Amount (birr)
Yield per lactation	whole milk (lit) (Yw)	432
	soured butter milk (lit) (Ys)	337
	butter (kg) (Yb)	33.7
Selling price (Birr)	per liter of whole milk (Pw)	10
	per liter of soured butter milk(Ps)	6
	per kg of butter(Pb)	130
Income from dairy (Birr)	Whole milk sold and consumed (Yw*Pw)	990
	soured butter milk sold (Ys*Ps)	2022
	Butter sold (Yb*Pb)	4381
	Appreciation from heifers/ calves	266.4
	Value of manure	666.9
	Average value of animal sold	754.3
Total gross value from dairy (Birr) (A)		9080.6
Total variable cost (birr) (TVC) (B)		2664.81
Gross Margin from dairy production (birr) (GM)= (A-B)		6415.79
Total fixed cost (birr) (TFC) (C)		356.68
Total cost (Birr) (D)		3021.49
Average cost per liter		6.99
Revenue per liter		3.01
Break-even revenue (Birr)		3021.49
Net income (NI)/ cow(TGM-TFC)		6059.11
Benefit-Cost Ratio (Bt/Ct)		3.00

Source: Own survey, 2014

Table 7 above discusses the result of profitability analysis of dairy farm. The profitability was assessed using gross margin, benefit-cost ratio, net margin and break-even point analysis. Accordingly, gross income, gross margin and net margin were computed to be Birr 9,080.6, Birr 3,750.98 and Birr 6, 059.11 respectively. The report on net margin is in disagreement with report by Dayanandan (2011) who reported lower value (Birr 896) per local milk cow.

On the other hand, the value for benefit-cost ratio and net benefit-cost ratio was 3 and2, respectively. This implies that for every Birr invested in dairy, there is 2 Birr extra generated given other factors**.** Average cost and revenue per liter of whole milk was 6.99 and 3.01 Birr, respectively. The share of cost of production per liter of milk was 70% of selling price per liter,

from which 30% of average return per liter was generated

This is disagreement with report by Nyekanyeka (2012). He reported cost of production and average return per litter to be 42% and 58%, respectively. of the selling price per unit of milk The break even revenue, break-even milk yield and profit was Birr 3, 021.50 , 302.2 liter and Birr 6, 059.11, respectively. About 70% of total milk yield produced used to over cost of production.

Estimates of the Multiple Regression Analysis

Table 8 presents the estimates of multiple regressions of socio-economic factors on value of gross margin.. Gender, number of milking cow and lactation period variables were statistically significant (Table 8).This indicates that annual gross margin from smallholder dairy strongly depends on these variables. However, experience in dairy production, number of livestock possessed, distance from center of extension service and access to credit were found to be statistically insignificant. Nyekanyka (2012) indicated that age, herd size and distance from milk cooperative were statistically significant. However, the same study indicated that gender, marital status, education and household size were statistically insignificant.

According to table 8, for every milk cow increase, the annual gross margin of the smallholder dairy farm would rise by Birr 3207.5. And also, when lactation period rise by one day, the rise in annual gross margin would be Birr 170 given other variables. With regard to gender, when sex of the dairy household is female, the contribution of every female being head, annual gross margin would rise by 27%.

Table 8. Estimates of Multiple Regression Analysis of Socio-Economic Factors Affecting Profitability of Smaller Dairy Farm

Variables	Un standardized coefficient		Standardized coefficient		
	B	***std error***	**Beta**	***t***	***Sign***
Constant	-0.851	4.75		-.179	0.859
Gender of the household head	-4.779	2.59	-.269	-1.85	0.0073
Number of milk cow	9.64	2.57	.502	3.75	.001
Experience in dairy production n	9.64	.097	.042	.283	.778
Number of livestock possessed	-.228	.326	-.102	.698	.489
Lactation period	.019	.010	.0265	1.829	.075
Distance from extension service	1.005	1.437	.099	.699	.489
Access t credit	-8.36	5.82	-.203	-1.436	.159

Dependent variable: annual gross margin, $R^2 = 0.328$

Analysis of Production Function

Production function measures the degree of responsiveness of output when the corresponding input was changed by 1%. The output of the regression analysis showed that the coefficient of concentrate was positive but statistically insignificant. This indicates that the provision of concentrate to milk cow by smallholder farmer was sub optimal, due to combined effect of limited economic access to concentrate and poor yielding performance of the local cow. According to regression analysis, the coefficient for dry and green fodder was positive and significant at 5% significance level. This indicates that dry and green fodder were both more important for smallholder dairy producer in Dale district as these inputs were economically and physically more accessible to dairy producers. On the other hand, the coefficient for labor was negative as expected but was insignificant. Focusing on the number of milking cow, the coefficient of number of milking cow was significant at 5% level. Furthermore, the sum of coefficients of regression analysis was less than one (0.86) (table 8). The sum of coefficients of regression analysis in smallholder dairy production indicated return to scale to be decreasing, showing that the existing dairy production was not efficient at farmer level. .

Furthermore, the value of adjusted R^2 shows that 50% of the variation in milk production was explained by the explanatory variables in the production function.

Constraints to Dairy Production and Marketing

Factors constraining return from dairy in the study area were categorized into supply and demand side factors. Among others, poor economic and physical access to quality feed, poor access to credit, lack of knowledge to adopt new technology and record farm data, seasonal local feed supply, poor performance of local milk cow, poor AI service due poorly trained technical and poor AI inputs (Nitrogen and Semen) supply and prevalence of disease were the major supply side factors affecting return from dairy.

Poor access to credit was reported by 69% the respondents to be their first important factors in dairy production. About 23% and 46% of the respondents indicated that seasonal local feed supply and poor economic and physical access to quality feed (concentrate) to be their first and 5th important problem affecting retrun from their dairy. . On the other hands, 38% and 30% of the respondents reported that poor performance of local cow and seasonal local feed supply as their 3rd and 4th important problem, accordingly. For 100% of respondents, disease was the least important problem in connection to the dairying process at farm level.

Seasonal milk supply depending on availability of feed, which in turn dependents on availability of rain was the 1st and 2nd important problem, reported by 23% and 77% of the respondents. Seasonal demand for dairy products, depending up on fluctuating income and long fasting period were the demand side problem reported by 69% of the respondents. Seasonal lack of buyer and price fluctuation were the other important factors in rural dairying, reported by 46% and 46% off the respondents, respectively (Table 10).

Table 9. Estimates of production function

Items	Coefficient	t- ratio
Constant	1.37	1.14
Number of milking cow	0.36**	2.42

Green fodder	0.017**	0.21
Dry fodder	0.15**	1.88
Concentrate	0.36	1.88
Labour	-0.029	0.13
R^2	0.5	1.14
F	0.8	
Sum of b_i	0.858	

CONCLUSION AND POLICY RECOMMENDATIONS

CONCLUSION

The survey result indicated that 90%of husbands and 46% of wives received formal education, from which 42% of the theses wives received the lower grades compared to their husband counterpart.

Labour division in dairy production and marketing within household varied depending on culture the society was experiencing. Barn clearing, cow milking, milk processing and managing income from sale of dairy products were the sole task of a wife in Dale district of Sidama Zone. On contrary, selling live animal and purchasing feed were solely managed by husband. The survey data depicted that milk yield was affected by season (whether feed is ample or scarce) of production and number of milking cow. Average milk produced per cow during wet season was found to be 2 times higher than milk produced during dry season. The average milk yield produced per day and over lactation period (288 days) was respectively 1.5 and 432 liters.

Income from dairy accounted for 35% of the total household's annual income. Dairy product sale stood the first acc accounting for 29.3% of the total dairy household income per year. In dairy, the variable cost accounted for 88.2% of the total cost from which feed cost accounted for 76% of the total cost. Gross income, gross margin and net margin per cow per annum was respectively Birr 9, 080.6, Birr 6, 415.79 and Birr 6, 059.11. With regard to regression analysis of the farm production efficiency, the coefficients of concentrate and labour were insignificant. On the other hand, the coefficient for dry and green fodder was positive and significant at 5% level.

Table 10.Constraints to dairy farm

Constraints	Rank of constraints (1st-8th)								
	% of respondents prioritizing the constraints								
	1st	2nd	3rd	4th	5th	6th	7th	8th	100%
Poor economic and physical access to concentrate	0	8	0	8	46	30	8	0	100
Poor access to credit	69	0	8	8	0	0	15	0	100
Lack of knowledge	0	8	15	8	8	0	0	61	100
Seasonal local feed supply	23	0	8	30	15	0	23	1	100
High feed cost	0	0	0	0	0	54	31	15	100
Poor performance of local cow	8	0	38	15	23	0	13	2	100
Poor AI service	0	0	0	8	0	15	0	77	100
Prevalence of livestock disease	0	0	0	0	0	0	0	100	100
Seasonal lack of buyer	0	0	8	46	31	0	0	23	100
Price fluctuation	0	8	46	31	0	0	0	15	100
Demand fluctuation	69	23	8	0	0	0	0	0	100
Milk supply fluctuation	23	77	0	0	0	0	0	0	100

Source: own survey, 2014

According to regression analysis, the sum of coefficients indicated that return to scale was decreasing. i.e., for every unit rise in input, the rise milk out was less than one indicating dairying in Dale district to be inefficient. Regarding to multiple regression, gender, number of milking and lactation period variables were significant at 1%, 1% and 10% significance level. With regard to dairy production constraints, lack of money and demand fluctuation were the major supply side and demand side factors affecting dairy's return, reported by 69% of the respondents for each to be the first important factor.

Policy Implication

- Despite of their major responsibility in dairy production and marketing activities, wives' education was by far less than education level received by the husband counterpart. Thus, empowering female/wives in dairy production and marketing through improving access to informal/formal education should be the focus of dairy development policy.

- As feed was the major cost aspect of the dairy farms, dairy farm owners should have their own farm land to grow animal improved feed and develop method to reserve feed for future feed short period. To make this process effective, improved forage seed with full technical support should be provided to farmers thereby encouraging farmers to commercialize the feed and their dairy so that farmer complement their livelihood.

- Government and other development concerned bodies should give attention to improved dairy processing technologies' dissemination as processed dairy products could generate 90% higher money than that of raw milk and help to preserve dairy products for longer leading farmer for better selling price.

- Government and other concerned entities should improve credit service so that dairy producers can make use of the credit whenever it is needed as it was reported by 69% of respondents it to be the first important side factor in rural dairy.

- Furthermore, promoting milk and milk products' consumption at schools, hospitals and other

institution must be one of the components in dairy development programs and strategies as demand fluctuation was reported to be important factor to affect income from dairy.

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