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ESTABLISHING THE ECONOMIC VIABILITY OF SMALL-SCALE DAIRY FARMING IN ZIMBABWE

A CASE STUDY OF MARIRANGWE AND CHIKWAKA SMALL-SCALE FARMING AREAS

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Abstract

The study sought to establish the economic viability of small-scale dairy farming in Zimbabwe and to formulate strategies to enhance its performance. The study was based on findings from two case studies of small-scale farming areas of Chikwaka and Marirangwe. The study found that small-scale dairy farming in Zimbabwe is not economically viable, with low capital efficiency rates resulting from poor utilization of existing resources. Strategies prescribed included the commercialization of fodder, establishment of breeding centers, tailor made financial products, improved governance at Milk Producer's Associations (MPAs) level and investment in milk quality by processors and sustainable exit strategies by NGOs.

Keywords: Asset Turnover Ratio; Capital Efficiency; Dairy Investment; Gross Margin; Milk Collection Center; Milk Producer Association; Total Variable Cost

INTRODUCTION

The distinguishing factor of the dairy industry in Zimbabwe as a whole is the socio-economic position of dairy farmers. It is clear that with the exodus of large-scale dairy farmers following the land reform program which started in 2000, the role and contribution of the small-scale dairy farmer towards national milk production has increased (Richardson, 2005). Thus, there is an urgent need for these small-scale enterprises to grow into economically sustainable units.

Background to the study

Formal milk production in Zimbabwe decreased drastically over the past 15 years from 250 million litres in 2000 to a mere 55 million litres in 2013 against a national demand of 120 million litres per year (Zimbabwe Dairy Industry Trust, 2014). This translates to a consumption rate of ten million litres per month of which four million litres was being met from local production and the balance of six million litres was being imported (Land O' Lakes, 2013). The imports were mainly in the form of Ultra-high Temperature (UHT) milk products and powders reconstituted locally. There was a total of 41 licensed dairy processors, of which 10 were large scale processors with production of over 3,000 litres per day, another 10 were medium scale and producing 1,000 to 3,000 litres per day and 11 were small-scale and producing under 1,000 litres per day (USAID, 2010).

Zimbabwe's dairy industry has historically been dual in nature (Karunaratne and Wagstaff, 2013; Marecha, 2009; Ngongoni et al, 2006). On the one hand, there is the large scale sector with large herd sizes of pure exotic cows and their crosses producing more than 5000 litres per lactation or 20 litres per cow per day and 98 percent of the total marketed milk (DZPL, 2013). These farmers have strong institutional linkages to dairy processing firms. On the other hand, there is the small-scale dairy sector which is mainly characterized by low producing indigenous cows and dairy crosses producing between 1 800 to 2 500 litres per lactation or four to eight litres per cow due to poor feeding regimes. The average herd on these farms consists of ten or less improved cross and local breeds. The farmers have weak institutional linkages to dairy processors. The milk in this sector is produced mainly for local consumption with the surplus being sold locally to neighbours and through established Milk Collection Centres (MCCs). This sector contributes only two to three percent of marketed national milk production (DZPL, 2013).

In 2013, 70 percent of dairy farming consisted of the small-scale dairy sector which consists mainly of resource-poor, famers with no title to their farms (owning the land "communally") and newly resettled farmers who replaced large-scale commercial farmers (Hanyani-Mlambo, 2000), also with no title to their farms (operating on the basis of "permits"). These small-scale dairy development projects dotted across the country have been bogged down by low productivity and have proven to be generally unviable business entities (Land O' Lakes, 2013). Several, donor funded agencies such as EU Stabex, Land O' Lakes Inc. Zimbabwe, We Effect, SNV and the International Livestock Research Institute have, however, made considerable inputs into the industry with little effect, resulting in donor fatigue. Thus, very few of them now remain active in only four of Zimbabwe's 10 provinces: Manicaland; Mashonaland; Midlands and Matebeleland. In total, only 481small-scale producers were either

delivering their milk to large processors or processing and selling their milk locally by 2913 (Land O' Lakes, 2013).

In addition to donor fatigue, Zimbabwe's small-scale dairy farming industry faces a myriad of problems impacting negatively on its viability. Firstly, there is the issue of stiff competition from nearby countries such as South Africa, Botswana, Zambia and Malawi. Currently cheap milk imports from the Southern African Development Cooperation (SADC) region have posed a threat that will force farmers out of production as local milk will be more expensive. There is limited dialogue among core value chain actors in the sector, which has contributed to inefficiencies within the marketing chain, resulting in reduced prices to the producer and increased prices to the consumer (Walshe et al, 2012).

Secondly, there is the problem of milk pricing and working capital financing. The prices paid to farmers by milk processors are negotiated through the dairy processors association and farmer associations. A number of factors such as input costs plus a profit margin are taken into consideration when setting the price. Currently, farmers are being paid a basic price ranging from forty-five to fifty cents per liter of raw milk (USAID, 2010). Under a quality premium scheme administered by the Dairy Services division of the Department of Research and Specialist Services, a farmer is paid a premium for producing quality milk, which can be as much as five percent above the basic price, while a penalty is charged for producing poor quality milk. The milk is assessed on the basis of bacterial and somatic cell counts. However, due to insufficient funding, Dairy Services has not been able to administer the scheme effectively and it is not uniformly applied across the processing companies (USAID, 2010). This has given greater leverage to milk buyers and processors, with some choosing not to pay producers the quality premium. Finance for working capital requirements such as artificial insemination services, vaccines, veterinary drugs and antibiotics that are necessary to improve the quality of the milk is currently not available for small-scale dairy producers at competitive interest rates.

The potential for growth in the industry exists, given that the milk processors are currently unable to satisfy local demand and are operating below full capacity, with the average capacity utilization rate being 35 to 50 percent. Some processors have closed some of their processing plants due to lack of supplies.

Research Problem

Zimbabwe's ability to capture the prospective economic benefits of an expanded dairy industry is constrained by a number of gaps. A decline in the number of commercial farmers supplying large-scale processors over the years has seen small-scale farmers taking a key role in the

supply of raw milk. Despite the involvement of several donor funded agencies, small-scale dairy farming in Zimbabwe has been riddled by slow growth and low productivity.

Research Objectives

The objective of the study was to assess the economic viability of small-scale dairy farms in Zimbabwe and to determine the factors influencing the viability of these farming units.

Research Questions

The research questions for the study were:

1. How economically viable are the dairy production units in terms of profitability, asset utilization and adequacy of returns to investors?
2. Is there any significant relationship between production costs and gross income in small-scale dairy units?
3. What non-monetary factors affect gross income of small-scale dairy farming units?
4. What factors influence the marketing of milk and milk products from small-scale dairy farms?

Scope of the Study

The study was confined to small-scale dairy farming units in Marirangwe and Chikwaka dairy development projects in the Mashonaland-East province of Zimbabwe.

LITERATURE REVIEW

Measures of the economic viability of farming enterprises

The Asian Development Bank (1999) measures the economic viability of projects in terms of the return accruing to the project operating entity or project participants. In this regard, for a project to be economically viable, it is expected to be financially sustainable as well as economically efficient. In addition, if a project is not financially sustainable, economic benefits will not be realized. Thus, financial and economic viability are complementary and therefore two sides of the same coin. Generally, however, there is no unanimity pertaining to indicators or methodologies most suitable for the measurement of the economic viability of agricultural holdings, with much difference of opinion (Scott et al, 2008; Popelier, 2005; Koleda et al, 2005).

For the determination of relative profitability, the gross margin and the net margin have been recommended as suitable measures for farm enterprises in several studies (Argiles and Slof, 2001; Chantalakhana, (2005); Rushton et al. 2009) The two margins are determined first by calculating all variable costs, the fixed costs and revenue associated with an enterprise. In these studies, variable costs included mainly bought-in concentrates and fodder, salt lick and

minerals, consumables (milking jelly and fuel), veterinary and insemination costs and hired labour. Fixed costs were made up of maintenance, repairs, water, electricity and milk transportation. These costs were calculated using market prices.

The difference between revenue and total variable costs is then determined, resulting in the gross margin or "contribution", which is an indication of the contribution of each unit produced to the recovery of the fixed costs of the business. The net margin is then found by deducting the fixed costs from the gross margin. These margins can further be divided by the revenue (Rushton et al, 2009). Dent et al, (2010) further argue that the gross margin is a useful measure for farming enterprises where quantitative enterprise data is available and profit maximization is the primary motivation. Rushton et al (2009) also suggest that the robustness of the business can further be tested by calculating the "break-even" level of activity measured in terms of units of output or sales revenue. The break-even is found by dividing fixed costs by the contribution. In a study carried out by the Tegemes Institute of Agricultural Policy and Development (2011), an economic analysis was conducted at farm level based on gross margin analysis in which the gross margin also served as the unit of analysis in evaluating the economic performance of an enterprise.

Some studies have used short-term and long-term solvency and capital efficiency measures such as return on sales ratio, debt to equity, interest coverage, return on assets and return on investment (Koleda et al, 2009) as measures of the economic viability of farming enterprises. The Australian Skills Quality Authority (2012) also recommends specific measures to assess economic viability, including: Net Tangible Assets; Working Capital Ratio; Current Ratio; Debt Ratio. These measures are mainly concerned with whether the entity has enough short term and long-term assets to cover its financial obligations.

Koleda et al (2010) argue that the orientation towards an effective operation in the market in the long-term is a function of farming being a process. They therefore argue that sales price, production volumes, expenses and decision making have the greatest impact on the economic viability of an agricultural enterprise.

Factors affecting the viability of smallholder dairy farmers

Other measures of a nonfinancial nature have been used in other studies, for example, a studies by Mumba et al (2011) in Zambia and also by Cain, Anwar Rowlinson (2007) in the Punjab region of Pakistan indicated that education levels, dairy cow herd size and distance to the market significantly affected the profitability of small-scale dairy farmers. Increases in education levels, cow herd size and a unit decreases in the distance to the market led to increases in the profitability of small-scale dairy enterprises. Conclusions by Ngongoni et al

(2006), based on a study of small-holder dairy farmers in Zimbabwe, the size of the household was found to be one of the most important determinants of viability in that it determined the labour investment for the enterprise and also influenced milk production for both home and market consumption. Further, it was found that the poor performance of small-scale dairy farmers as measured by low milk yields, low calving rates, late age at first calving and long calving intervals were attributable to low levels of nutrition and poor management. These findings were further corroborated by Agyemang and Nkhonjera (2010) and also by Tsabedze (2012) in Malawi.

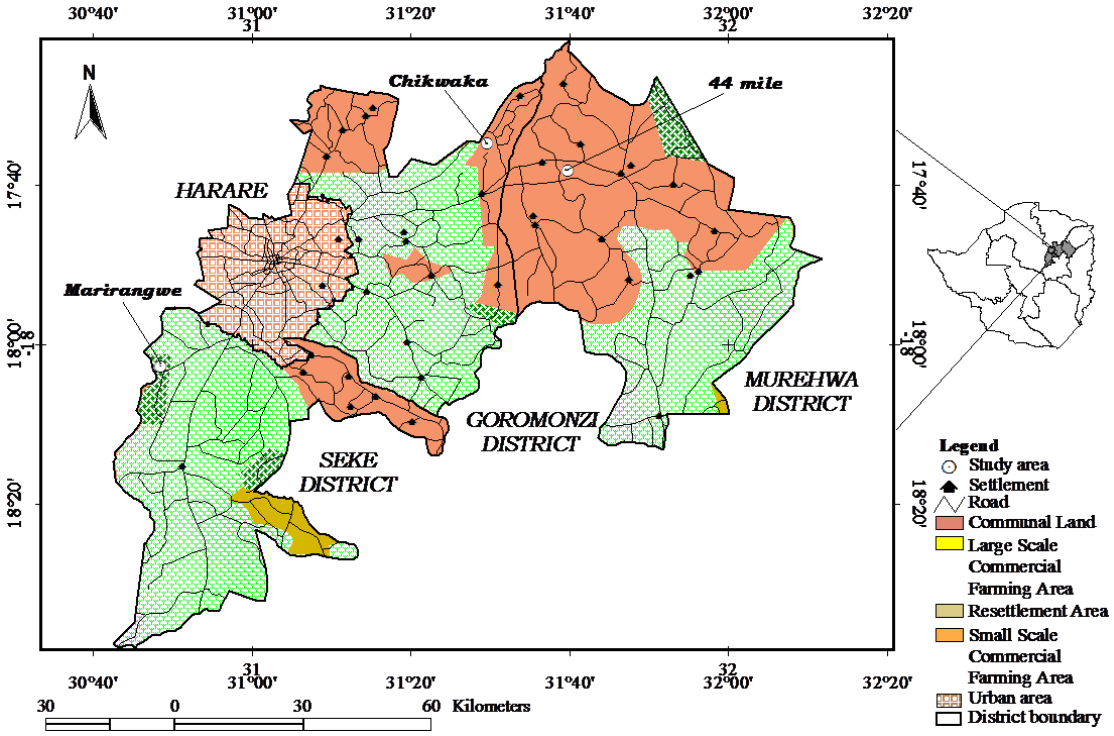
Other studies by Mburu et al (2007) and Zvinorova (2010) in Zimbabwe concluded that differences in viability amongst small-scale dairy farmers were the result of differences in access to markets and services. It was further concluded that there was a strong and positive correlation between gross margins and the number of milking animals that farmers should keep to remain profitable. Thus, highly resourced farmers with relatively large herd sizes enjoyed higher returns on investment than others. These findings were also in line with those from other studies such as Shoemaker et al, (2008), Kaitibie et al (2008) and Kavoi et al (2010) which used the dairy investment per cow as a measure of farm viability on the assumption that the dairy investment per cow allows one to measure the efficiency of the money invested in the dairy farm.

A study by the World Bank (2011) in Zambia found that small-scale dairy farmers can achieve competitiveness by combining both traditional and modern commercial farming methods in their enterprises. For example, the farmers were able to achieve good yields for their cross-bred cows up to ten litres per day and earned over US$3,000 a year representing a good return on the cost of buying the cows.

METHODOLOGY

The study employed a survey in Marirangwe and Chikwaka areas, Zimbabwe using a questionnaire distributed to small-scale dairy farmers. Marirangwe small-scale dairy scheme in Seke district is located 35 kilometers south of Harare. The average farm size is 40 hectares per farm. Chikwaka communal lands in Goromonzi District are located 51 kilometers east of Harare. The average farm size farm is about 0.5 hectares. The study area is shown in Figure 1.

Figure 1. Study Area Map



Study population

The population of the study comprised small-scale dairy farmers in Marirangwe and Chikwaka. Some of the farmers are members of a Milk Producers' Association (MPA) who deliver their milk to a Milk Collection Centre (MCC) whilst others are not and sell their milk within the locality in which they reside. The total number of dairy farmers in Marirangwe was 51 of which 35 were registered with an MPA. The total number of farmers in Chikwaka was 62 of which 37 were registered with an MPA.

Study sample and data collection

The study used a stratified random sample of 72 farmers from Marirangwe (35) and Chikwaka (37. The sample consisted of small-scale farmers who were members of an MPA and actively delivered their milk to a MCC and farmers selling milk to buyers other than the milk collection center were not included in the sample. The reason for excluding farmers who were non-members of an MPA was that since the farmers in the two sites were dairying under different socio-economic conditions, the factors affecting the economic viability of their enterprises were also expected to differ.

The questionnaire was designed to collect the demographic information of the farmers as well as socio-economic data, sources of income, herd sizes, daily milk production, veterinary

costs, feed costs, breeding costs, labour costs, marketing of milk and milk products and extension services. Interviews with government field extension officers, MPA Chairpersons from Marirangwe and Chikwaka were also carried out to collect information pertaining to policy implementation, financing of DDPs as well as coordination of MCC activities.

Data analysis Approach

Calculation of total variable cost, gross income and gross margin

The total variable cost (TVC), total gross income (TGI) and the gross margin per farm was calculated using the following measures (Astride and Jurate, 2014; Otieno et al, 2009).

i. TVC = VC + FC + BC + MC ;
ii. TGI = (DMP/cow) x (MP/litre) x (N) x (305 days);
iii. GM = TGI – TVC

where: TVC = total variable cost (annual);

TGI = total gross income (annual)

GM = Gross margins (annual);

VC = annual veterinary costs;

FC = annual feed costs;

BC = annual breeding costs;

MC = costs related to marketing of milk and milk products;

DMP = dairy milk production per cow;

MP/litre = milk price per litre;

N = number of lactating cows;

305 days represent the duration of lactation.

Calculation of capital efficiency parameters

Capital efficiency was determined through the estimation of dairy investment per cow and asset turnover ratios.

$$\text{Dairy investment per cow} = \frac{\text{Total dairy investment}}{\text{Number of cows}}$$

Where the total dairy investment includes the total cost of all dairy infrastructure on farm.

$$\text{Asset turnover ratio} = \frac{\text{Gross income}}{\text{Average total farm assets}}$$

These ratios indicate how efficiently the money on a dairy farm is invested (Astride and Jurate, 2014).

The data was analysed using the Statistical Analysis System (SAS) Version 9.3Package for Social Scientists (SPSS), Version 21. Data was analysed on gender of household head, dairy breeds, marital status level of education and other demographic information were analysed using the frequency procedure of SPSS. Means were computed for variables such as household size, number of household members, herd sizes, milk production, gross income, veterinary costs, feeding costs, breeding costs, labour costs, marketing costs and transport costs. The mean gross margins, veterinary costs, feed costs, transport costs, labour costs and breeding costs for the two sites were compared using the t-test for independent samples.

The effect of various cost components on gross margin for the two study sites were evaluated using the multiple regression analysis of the form:

$y = \beta_o + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6$

where: y is the gross margin ($)

β_o is the intercept;

β_1 is partial linear regression coefficient relating feed cost (x_1) to gross margin;

β_2 is partial linear regression coefficient relating vet cost (x_2) to gross margin;

β_3 is partial linear regression coefficient relating breeding cost (x_3) to gross margin and

β_4 is partial linear regression coefficient relating transport (x_4) to gross margin.

Pearson's correlation coefficients were estimated to determine the degree of association between costs of production and total variable costs.

The effect of non-monetary factors on gross income for the two study sites was evaluated using the stepwise multiple regression analysis of the form:

$y = \beta_o + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6$

where: y is the gross income ($)

β_o is the intercept;

β_1 is partial linear regression coefficient relating number of lactating cows (x_1) to gross income;

β_2 is partial linear regression coefficient relating feed cost (x_2) to gross income.

EMPIRICAL FINDINGS

Demographic information

The average household size was the same in both cases with an overall mean household size of 5.3. The size of the household was indicative of availability of labour on the farm (Osotimehin et al, 2006) as most of the farmers were using family labour with very little or no casual labour. The farming operations were male-dominated, with 95 percent of the households in Marirangwe and 66 percent of those in Chikwaka being male-headed. The level of formal education for the

head of the household was reasonably high, with 40 percent of the heads in Marirangwe and 30 percent of those in Chikwaka having attained secondary level education. More than 50 percent of the household heads reported having received basic training in agricultural practices as a Master Farmer, Advanced master farmer or at Diploma level. The average dairying experience for the head of the household was more than 10 years in Marirangwe and 5 years in Chikwaka.

Table 1: Demographic information for Marirangwe and Chikwaka areas

Variable	**Marirangwe**	**Chikwaka**
Mean household size	5.2	5.5
Gender of H/head **(%)**:		
Male	95	66
Female	5	34
H/Head Level of formal education (%):		
Primary	4	18
Secondary	40	30
Tertiary	2	4
Basic Agric. Training for H/Head (%)	43	53
Experience in dairying (years)	10.5	5

NB: MF – Master Farmer; AMF – Advanced Master Farmer; Agric- Agricultural

Herd size, milk yield, feeding regime and land pasture

Table 2 shows the mean number of cattle by class, number of lactating cows, daily milk production, number of stock at start of year, period of milking, monthly feed consumption, land allocated for pasture.

Table 2. Average herd size, milk yield, feed (kg) and pasture per household

Variable		**Number of respondents**	**Mean**	**Max.**
Number of cattle:	Marirangwe	26	4	30
	Chikwaka	32	2	16
Daily milk yield (l):	Marirangwe	26	19	92
	Chikwaka	32	4	32
Monthly feed (kg):	Marirangwe	26	19	180
	Chikwaka	32	21	300
Land pasture (ha):	Marirangwe	26	0.23	2
	Chikwaka	32	15	200

The average dairy herd size per household was 4 cows though there was wide variability with some farmers owning up to 30 cows. The milk yield per household per day was 19 litres in Marirangwe and 4 litres in Chikwaka, though some households in Marirangwe were yielding up to 92 litres. The feeding regimes were almost the same in both cases with households using an

average of 19 kg of feed per month in Marirangwe and 21 kg in Chikwaka. Some households in Chikwaka used up to 300 kg of feed per month. The land pasture was very small in Marirangwe though some farmers in Chikwaka had large pasture lands of up to 200 hectares.

Variable costs and gross margins

Veterinary costs, transport costs, labour costs, feed costs, breeding and gross margins for both cases were computed and comparisons made using the t-test for independent samples at the 95 percent significance level ($P<0.05$). It was found that there were significant differences in these in the gross margin ($t = -2.64$; $P=0.0112$) and the total variable cost ($t = 2.02$; 0.0495). However, there were no significant differences ($P>0.05$) in veterinary costs, labour costs and transport costs between Marirangwe and Chikwaka dairy farmers.

Table 3 shows the gross margins for Marirangwe and Chikwaka farmers. The calculation of farm gross margins was based on estimations of production costs and income from milk sold to the milk collection centre and milk consumed. However, the analysis did not include the deduction of fixed costs and the value of dairy animals at the beginning and end of the year.

Table 3: Average gross margin analysis (USD)

	Marirangwe	**Chikwaka**
Total gross income for dairy enterprise	**2,792.42**	**568.44**
Variable Costs		
Feeds (purchased plus home-grown ie forage-seed, fertilizer, hay/ silage)	2217.69	568.76
Veterinary costs (drugs + vaccines)	152.27	136.70
Breeding cost (AI/Bull hire)	9.65	25.72
Labour cost (hired + Family Labour)	530.77	337.50
Transport costs	101.54	51.19
Total Variable Costs	**3,011.92**	**1,119.87**
Gross Margin (Gross Income – Variable Costs)	**-219.50**	**-551.43**
Mean Gross Margin per Cow	-54.88	-275.72
Mean Gross Margin per litre	-0.04	-0.48

The results ultimately show that small-scale dairy farmers in Marirangwe and Chikwaka were not economically viable. Mean annual gross margins were negative in both areas. The mean daily milk production per cow per day for dairy crosses was four litres in Marirangwe versus two litres in Chikwaka resulting in a mean negative return per litre of -US$0.04 and -US$0.48 respectively.

Capital Efficiency

The capital efficiency of the dairy enterprises in both cases is shown in Table 4. The average investment per dairy cow and mean asset turnover ratio were compared using t-test for independent samples at the 95 percent significance level. It was found that there significant differences in the average investment per cow (t = -3.05; P = 0.0052. The mean asset turnover was also computed and significant variances were also found (t = -2.08; P = 0.0469). The mean investment per dairy cow and asset turnover was found to be higher in Marirangwe than in Chikwaka implying that there was more efficient use of investment funds. Farmers in Marirangwe invested $1,506 per cow and obtained a return of 18 cents per dollar invested, whereas farmers in Chikwaka invested $1,110 per cow and realized a return of 5 cents per dollar invested. These fell short of the recommended level of US$7,000 (Shoe-maker et al, 2008). The mean asset turnover ratios were also below the recommended threshold more than 0.60 (Shoe-maker et al, 2008).

Table 4: Capital efficiency - Marirangwe versus Chikwaka

Area	Mean investment per cow ($)	Mean asset turnover ratio ($)
Chikwaka	1110.40	0.0491
Marirangwe	1506.50	0.1808

Cost components affecting gross income

The influence of cost components (feed cost, veterinary cost, labour cost, transport cost and breeding cost) on gross income were evaluated using step-wise multiple linear regression of feeding costs, transport costs, breeding costs, veterinary costs and labour costs on gross income (US$). Corresponding correlations between these cost components and gross income were also determined through estimation of the Pearson's correlation coefficients. Only the significant association were included in the regression models although all correlations, significant or not, are indicated below.

Veterinary costs and transport costs were important and significant. In Marirangwe, gross income was significantly ($P<0.05$) influenced by veterinary costs ($\beta=5.978$) and transport costs ($\beta=6.478$). Feed costs, labour costs and breeding costs had no significant influence on gross income ($P>0.05$). The resultant regression equation was:

$y_{ijk}=826.39 + 5.978x_1 + 6.478x_2 + e_{ijk}$

where: y_{ijk} is the gross income in US$

x_1 are the veterinary costs;

$x_2$represent the transport costs.

E_{ijk} are the random residuals.

Gross income increased with increasing veterinary and transport costs implying that farmers earned more as they invested more in animal health. Healthy cows obviously produce a lot more milk and therefore more income to the farmers. Gross income also increased with transport costs implying that the more deliveries made to the MCC, the more income accruing to the farmer. This might however not include the cost of repairs to damaged transport modes. The resultant regression equation of veterinary costs on gross income was:

Yijk= 826.39 + 5.978x1 + eijk

Breeding costs were not significant. In Marirangwe 10 percent of the farmers used artificial insemination methods, 80 percent used natural bulls and 10 percent used both bulls and artificial insemination. Although 80 percent of the farmers used natural bulling methods, 70 percent of the farmers were not cognizant of the breed used and hence the majority let indigenous bulls mate with their dairy cows. In Chikwaka, three percent used artificial insemination, 90 percent used natural bulls and six percent used both artificial insemination and natural bulls. Although breeding costs in Chikwaka were higher than Marirangwe, the use of free range grazing methods also exposed the dairy cows to inferior breeds of bulls and hence offspring dairy blood is diluted.

The gross income for dairy farmers in Chikwaka were significantly ($P<0.05$) influenced by feed costs ($\beta = 6.478$). All the other costs related to labour, breeding, transport and feeding did not significantly influence gross incomes ($P>0.05$). The resultant regression equation was:

$y_{ijk}=826.39 + 6.478x_2 + e_{ijk}s$

where: y_{ijk} is the gross income in US$

x_2 are the feed costs;

e_{ijk} are the random residuals.

Gross income increased as farmers increased their investment in feeding since animals are biologically known to produce more milk when better fed translating into more income from milk sales.

Correlations between gross income and cost components

Table 5 shows the correlations between the gross income and the cost components for Marirangwe and Chikwaka small-scale dairy farmers. In both Marirangwe and Chikwaka, gross income showed a weak and non-significant ($P>0.05$) relationship with labour costs and breeding costs respectively. Significant correlations ($P<0.05$) were observed between gross income and transport costs (Marirangwe), veterinary costs (Marirangwe) and feed costs (Chikwaka).

Table 5: Correlation (s.e. in parenthesis) between gross income and cost components for Marirangwe and Chikwaka

Cost component	Gross income	
	Marirangwe	Chikwaka
Feed Cost	-0.170 (0.4057)	0.582 (0.0005)
Veterinary Costs	0.498 (0.0097)	0.116 (0.5257)
Breeding Costs	-0.033 (0.8732)	-0.218 (0.2309)
Labour Costs	0.330 (0.0996)	0.173 (0.3433)
Transport Costs	0.506 (0.0083)	0.187 (0.3050)

Non-cost factors influencing gross income of the farmers

The non-cost factors that were tested were the number of lactating cows, feed consumed and the total area allocated for grazing. These were evaluated using step-wise multiple linear regression to establish is there was an association between these and the gross income.

In Chikwaka the gross income was significantly ($P< 0.05$) influenced by the number of lactating cows (β=375.62) within the herd as well as the amount of feed consumed (β=0.28) by the animals. As the number of lactating cows increased within the herd, so did the milk produced and income accruing to the farmers. The same applied to feed consumption. This is shown in the regression line:

y_{ijk}=-67.5 + 375.62x_1 + 0.28x_2 + e_{ijk}

where: y_{ijk} is the gross income in US$; x_1 are the number of lactating cows;x_2 represent the feed consumption and E_{ijk} are the random residuals.

In Marirangwe the gross income was significantly ($P<0.05$) influenced by the number of lactating cows (β=761.37) within the herd. As the number of lactating cows increased within the herd, so did the milk produced and income accruing to the farmers. The following was the regression line:

y_{ijk}= -658.36 + 761.37x_1 + e_{ijk}

where: y_{ijk} is the gross income in US$

x_1 are the number of lactating cows;

e_{ijk} are the random residuals.

In Marirangwe total feed costs constituted 73 percent of total variable costs and 79 percent of gross income. Thus, the investment in feed concentrates was significantly high, comprising 85 percent of total feed costs whilst the farmer investment in home grown feeds such as silage and hay only accounted for 15 percent of total feed costs. In Chikwaka, though the investment in feed costs was low, with feed costs constituting 51 percent of total variable costs, most of the farmers (75 percent) relied on free range feeding regimes. This is not recommended for dairy cows that require a combination of feed concentrates for milk production

and home grown feeds for body maintenance. The investment in home grown feeds was close to 30 percent of the total feed costs.

Factors influencing the marketing of milk and milk products

The factors influencing the marketing of milk and milk products of small-scale dairy farmers are coined around four principle factors which are the product, pricing, place and promotion. In Marirangwe, all the farmers were delivering their milk to the MCC whilst 75 percent of farmers in Chikwaka were delivering to the MCC. About 20 percent of Chikwaka farmers were selling through middlemen and 5 percent were selling locally within the village. However, in the records of the Associations the latter mentioned (20 percent selling through middlemen and five percent to the locality) were still members of the MPA.

In Marirangwe all the farmers were supplying raw fresh milk whilst in Chikwaka, 70 percent were supplying raw fresh milk and 30 percent were supplying sour milk (Amasi). The farmers who were engaged in value addition selling locally in the village or through middlemen. It was established that they were not supplying the MCC with raw fresh milk.

A number of factors were identified which influenced the marketing of milk and milk products by small-scale dairy farmers. These were: low prices; late payment; long distance to the market and poor leadership. The marketing of milk and milk products of small-scale dairy farmers was strongly influenced by pricing of the product which the farmers indicated was lower than costs of production. The mean price given to farmers in Marirangwe was US$0.48 against a mean cost per litre of US$0.52 resulting in a loss of US$0.04 per litre. In Chikwaka the mean price given to the farmer was US$0.49 against a mean cost per litre of US$0.97 resulting in a loss of US$0.48. The farmer had no control over the price set. An interview with the Chairperson of Marirangwe Dairy Farmers' Association revealed that the price per litre was determined by the operational costs per litre incurred by the MCC. The low pricing was as a result of low milk volumes, high operational costs and poor quality milk brought in by the farmers. Chikwaka milk was being purchased by one company only (DZPL) and quoted price per litre ranged between US$0.42 and US$0.45 over a one-year period. However these prices were not cognizant of the high costs of production per litre at farm level of US$0.52 and US$0.97 for case study areas.

The most common mode of milk transportation used by the farmers in both cases was rudimental as 55 percent of the farmers reported that they used bicycles as the mode of transport for their milk. Thus, distance was another key factor that affected the marketing of milk products by the farmers. Most of the farmers in Marirangwe (76%) lived between five and ten kilometres from the nearest milk collection centre and in Chikwaka 74 percent lived between from the nearest milk collection centre.

Access to loans

Over a one-year period, over 87 percent of the farmers in both cases were able to access credit facilities to finance their dairy enterprises.

Table 6: Access to credit facilities

Loan Type	Marirangwe	Chikwaka
Heifer only	43	48
Cash only	5	10
Feed only	5	2
Drugs only	5	3
Heifer, drugs, feed and cash	37	16
Total	**95**	**79**

The bulk of the loans were for the purpose of purchasing heifers only or for all the requirements, including heifers, drugs, feed as well as cash for working capital purposes. Most of the farmers received their loans from the Milk Producers Association through donor funded aid such as the 'Heifer Revolving Fund' and the 'Cattle Bank Facility' (CBF) managed by the European Union. Others also accessed loans from the milk processor in their area. The amount of the aid was, however, very limited. For example, the farmers were limited to only one n-calf heifer per household and the total package did not exceed $1 500 per household.

Governance and management of associations and donor assistance

There were three Milk Collection Centres (MCC) in Chikwaka and four in Marirangwe, with each MCC being managed by a Management Committee elected by the milk producers. The farmers were also constituted into two Milk Producers Associations (MPA) and each MPA was managed by a Chairman, Treasurer and a Secretary. These office bearers were chosen by popular vote with no other criteria being used. Several organisations were also involved in providing assistance to the farmers, the most prominent of which were Land O' Lakes, We Effect and ZADF. These organisations had invested heavily in small-scale dairy farming in Zimbabwe. However, the project implementation time frame was found to be very short, with most projects terminating after only two years of implementation. This proved to be a drawback in that the impact of the project could not be realised and measured properly.

DISCUSSION OF THE FINDINGS

The study established that small-scale dairy farming in Zimbabwe was not economically viable. This was shown by negative gross margins, low capital efficiency ratios and low dairy investment per cow in both case study areas. The farmers were, however, well-experienced and

educated, though it was a male-dominated industry. This implies that the farmers from both areas had a high likelihood of adopting improved farming technologies. Households with experience and formal education in dairying are able to feed their animals, diagnose and control diseases more effectively than others (Makokha et al (2007).

Low viability was due to the fact that the farming operations were not efficient in that they were realising negative gross margins and also low returns per dollar invested in a cow. This can be attributed to several factors. Firstly, the exposure of the dairy cows to free range grazing practices combined had a negative impact on the output of milk received. Further to this, poor management practices, such as the failure to dip, dose or vaccinate their animals regularly and the use of non-standard feeding also contributed to lack of viability. Secondly, investment in reproductive costs was also significantly low as the breed of the animal used determines the output.

The positive relationship between production costs and gross income indicated that investing more in dairying could increase income accruing to the farmer and ultimately profitability. It also indicated that income accruing to the farmer increases with investment in transport, feed and veterinary services since healthy animals tend to produce more milk which requires a lot more deliveries, transport, to the MCC. Gross income increased with the number of lactating cows for both case study areas. It is evident that investment in feed has the potential to increase output per cow and hence ultimately income generated by small-scale dairy farmers. Hence, if farmers have access to fodder supplies, output per cow is expected to increase and ultimately income. The number of lactating cows also had a bearing on income generated. From the study, an increase in the number of lactating cows has the potential to increase income as a result of increase in milk produced. It is evident that the supply of dairy cows suitable for small-scale farmers in Zimbabwe is limited.

RECOMMENDATIONS

At the policy level, there is need to invest in breeding centers to provide small-scale dairy farmers with affordable dairy crosses and breeds that can tolerate adverse climatic conditions. The greatest challenge to farmers was access to suitable financial products to invest in their enterprises. Thus, there is need to introduce tailor-made financial products suitable for small-scale dairy farmers. The MCCs could attract higher volumes and better quality by introducing quality and volume based incentives or premiums on pricing. At policy level, government should also encourage processors to invest heavily in training on milk hygiene and quality by deploying extension staff into farms.

The choice of management committees elected to run the operations of the MCCs is critical as it also has a bearing on the sustainability of these businesses. At constitutional level, the expected qualifications and qualities of management committees and hired staff should clearly be outlined in the constitutions of MPAs. Critical positions such as Chairmanship, Treasurer and Secretary should be held by people with the relevant qualifications to efficiently run these MCCs as businesses and not social enterprises. Staff hired such as administrators, milk attendants, processors and drivers should also be in possession of the relevant qualifications.

There is a need for five to ten year funded projects to allow for teaching, mentoring and full adoption. Although the government has partnered with development organisations in the past, they have not been able to continue delivering extension services proficiently after the project ends because of limited resources and capacity. Hence the need to advocate for longer term projects from donor organisations.

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