THE ECONOMIC VIABILITY OF SMALL-SCALE DAIRY FARMING IN ZIMBABWE: A CASE STUDY OF MARIRANGWE AND CHIKWAKA

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ABSTRACT

The significant decline of large scale commercial dairy farmers in Zimbabwe has seen the role of small-scale dairy farmers as key producers and suppliers of milk being up scaled. However, this category of dairy farmers is resource poor and riddled by constraints that restrain their potential to be economically viable. The study sought to establish the economic viability status of small-scale dairy farmers in Zimbabwe and formulate strategies that will enhance their performance.

The study was conducted in Marirangwe small-scale commercial and Chikwaka small-scale communal areas. A review of current literature on dairy farming with emphasis on small-scale farms sought a case-study review of their viability status in Southern and Eastern Africa. The findings of researchers in these countries established that small-scale dairy farming is either unviable or has minimal profit margins. However, the researchers were only confined to gross margin analysis to establish the economic viability of these farms and did not take heed of other measures like asset turnover ratios.

The economic evaluation of small-scale dairying from this study indicated that it was not viable in Marirangwe and Chikwaka. Low capital efficiency ratios were as a result of poor utilization of existing resources. Strategies prescribed included the commercialization of fodder, establishment of breeding centres, tailor made financial products, improved governance at Milk Producer's Associations (MPAs) level, investment in milk quality by processors and sustainable exit strategies by NGOs.

ABBREVIATIONS

ATR	Asset Turnover Ratio
DDP	Dairy Development Programme
DMB	Dairy Marketing Board
DZPL	Dairy Zimbabwe Private Limited
ESAP	Economic Structural Adjustment Programme
GDP	Gross Domestic Product
GIS	Geographic Information System
GRDC	Grains and Development Corporation
ILO	International LabourOrganisation
IMF	International Monetary Fund
MCC	Milk Collection Centre
MPA	Milk Producers' Association
NDC	National Dairy Cooperative
NGO	Non-Governmental Organisation
RBZ	Reserve Bank of Zimbabwe
SAS	Statistical Analysis System
SPSS	Statistical Package for Social Sciences
UHT	Ultra-high Temperature
USAID	United States Agency for International Development
ZADF	Zimbabwe Association for Dairy Farmers

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CHAPTER 1

1. INTRODUCTION

1.0 Introduction to the study

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 programme which started in 2000, the role and contribution of the small-scale dairy farmer towards national milk production has been up-scaled.The vast majority of these small-scale producers are characterised by a weak and vulnerable position in the market. However if these small-scale dairy enterprises do not grow into economically sustainable units, the ripple effects at national level will be devastating.

This study seeks to establish the current economic viability status quo of small-scale dairy farmers in Zimbabwe and devise strategies that will see these scales acceptable as key suppliers and customers in the dairy value chain.

1.1 Background to the study

In 2012 Zimbabwe was producing approximately five million litres of milk per month through the formal market, a nine percentage point increase from the previous year (Zimbabwe Dairy Industry Trust, 2012). The reported increase was due in part to local production entering the formal market. However, in 2013 a slight decrease of two percentage points translating to 55 million litres per annum down from 56 million litres was experienced. According to the Zimbabwe Dairy Services Report (2014) annual national milk production gradually declined between 1996 and 2013 by 73 percentage

points from 200.9 million litres per annum. Within this period (1996 to 2013) the lowest annual milk production of 47 million litres was recorded in 2010.

Such challenges have seen Zimbabwe over the years gravitating towards being a net importer of milk against a national demand of milk of 120 million litres per annum (Zimbabwe Dairy Industry Trust, 2013). At its peak, the country used to produce 250 million litres of milk a year forcing farmers at times to literally throw milk down the drain to keep prices firm as an oversupply could have meant lower producer prices (Land O' Lakes, 2012)

According to Hanyani-Mlambo(2000), the center of attention in agricultural development in Sub-Saharan Africa has seen a shift towards the smallholder sector which is home and employment provider to more than 70 percent of the population. Nevertheless, reality on the ground and the viability status of enterprises within this sector remain largely un-probed areas of research.

Hanyani-Mlambo (2000) states that the small-scale dairy sector is made up mainly of resource-poor farmers who comprise over 70 percent of Zimbabwe's agricultural producers. It encompasses the communal, small-scale commercial, resettlement and commercial farming areas. Chavunduka (2001) pointed out that smallholder production before independence was essentially for subsistence purposes. This enterprise promotes regular monetary earnings to people who normally access cash once a season after harvesting their sole crop. A favourable cash flow chart and a transformation of lifestyles of rural households has been the result of regular monetary earnings from the sale of milk and its products. Small-scale dairy farming has seen

African people involved in the mainstream of the cash economy and poverty alleviation initiatives of their countries (Mano, 2010).

In Zimbabwe, over the years these small-scale dairy development projects dotted across the country have been bogged down by low productivity, poor growth, lack of competitiveness and hence proven unviable (Land O' Lakes Annual Report, 2013). To date donor funded agencies such as EU Stabex, Land O' Lakes Inc. Zimbabwe, We Effect, SNV and the International Livestock Research Institute have been mandated to facilitate the resuscitation of these dairy schemes which were established by Arda Dairy Development Programme (DDP) in the 1980's, many of which had collapsed over the years. Currentlyout of the thirty five, 18are functional in four provinces, namely Manicaland, Mashonaland, Midlands and Matebeleland. In total481small-scale producers are either delivering their milk to large processors or processing and selling their milk locally (Land O' Lakes Annual Report, 2013).

Hanyani-Mlambo (2000) further states that a gross margin analysis at farm level established that small-scale dairying in Zimbabwe is hardly viable. Constraints to production were identified to include labour bottlenecks, inadequate feeding bases, poor breeding practices and production inefficiencies. Problems arising from limited markets, narrow product bases, recurrent droughts and stringent economic reforms have had devastating effects on viability in the small-scale dairy sector.

1.2 Background to the Dairy Industry in Zimbabwe

Following a long standing historical legacy, Zimbabwe has been characterised by a dualised agricultural sector reflected in land quantity and quality, gross income and

wealth inequalities between and within agricultural subsectors and population groups (Hanyani-Mlambo, 2000).This dualised agro industry comprises, the large-scale and small-scale dairy farmers that vary with scale of production.

The large scale dairy sector commenced in 1910 and foresees farms large in size with high producing pure exotic cows and their crosses producing more than 5000 litres per lactation (Ngongoni 2006). This sector produces 98 percent of marketed milk for the nation (DZPL, 2013). However the small-scale dairy sector is mainly characterized by low producing indigenous cows and dairy crosses producing between 1 800 to 2 500 litres per lactation. Milk is mainly produced for home consumption with surplus 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).

Milk demand in Zimbabwe is currently estimated at ten million litres per month part of which is met from local production four million litres and imports six million (Land O' Lakes, 2013). The imports are mainly in the form of Ultra-high Temperature (UHT) milk and powders that are reconstituted locally. The main buyers and processors of milk that enters the formal market are Dairiboard Zimbabwe Private Limited (DZPL) with 38 percent market share, Den Dairy 26 percent, Kefalos 17 percent, Kershelmar Dairy nine percent, Nestle eight percent, and Candy two percent. In addition, there are other smaller dairy processors such as Dorking Dairy; Dunjuice and small-scale dairy processing projects supplying localized areas that are located mainly in small-scale farming areas across the country (USAID, 2010).

Nationally, there are 41 dairy processors with licenses. Of those, ten are large scale processors with production of over 3,000 litres per day, ten are medium scale producing 1,000 to 3,000 litres per day, and 11 are small-scale producing under 1,000 litres per day (USAID, 2010).

Mano (2010) categorises the structure of the dairy production system in Southern Africa into three, large-scale, emerging small-scale semi-commercial and traditional cattle holding farming sectors. The large-scale comprises average herd sizes in the hundreds of pure breeds, average milk yields of ten to 20 litres per cow per day and strong institutional linkages to dairy firms. The emerging small-scale semi-commercial dairy sector work with average herd size of ten or less improved cross and local breeds. Average milk production per cow per day ranges between four to eight litres. Their greatest constraint is that of weak institutional linkages to dairy processors. However the traditional cattle holding farming sector is characterized by large numbers of traditional cattle between one and 50 and less than ten dairy crosses. Feeding regimes are poor and hence milk yields are as low as two or less litres per cow per day. They have very poor access to input markets and almost non-existent links to formal marketing regimes.

1.3 Structure and evolution of the small-scale dairy sector in Zimbabwe

Post Zimbabwe's independence in 1980, a remarkable increase in disposable incomes with relatively low consumer prices was noted. This resulted in a high demand for food commodities, including dairy products. In addition, prices of dairy products were kept low by government subsidies (Pascoe and Borland 2011). Urban consumption of milk was approximated at 68 litresper capita as compared to 19 litresper capita in the rural

areas when was this. Henson (2010) states that per capita rural consumption estimates reflect supply rather than demand, hence a suppressed rural demand of 45 litres per capita was estimated.

As a possible means of increasing milk production to meet this demand and to improve milk supply, small-scale dairying was therefore adopted. This was especially targeted at the rural population situated far from the formal distribution centres (Karunaratne and Wagstaff, 2013). In 1983 a Dairy Development Programme (DDP) was established. It was mandated to set up small-scale dairy schemes with the participation of communal, small-scale and resettlement farmers. The programme was designed to broaden the production base of milk and to enhance commercial dairying. An increase in the amount of dairy products available to rural consumers was foreseen to make a significant contribution to rural development. It was envisioned that if triumphant, small –scale dairying could provide regular monthly income and all year round employment for rural people counteracting rural migration and therefore reducing the growth of urban slums (Bachmann 2003).

The Dairy Development Programme through donor funding facilitated the inception of 35 small-scale dairy projects across Zimbabwe. To-date there are 18 small-scale dairy development projects at various stages of development operating in four provinces. All schemes have a milk collection center fully equipped with collection and storage facilities. Eight schemes are part of the national bulk milk collection scheme and therefore deliver to processors located in major towns. The remaining ten schemes bulk their milk and sell it in its raw fresh or a fermented/cultured state (amasi/hodzeko).

Hence the latter schemes are heavily dependent on near-by local markets (Henson 2010; Mupunga and Dube 2005; Land O' Lakes, 2013).

Small-scale dairy schemes similar to the Zimbabwean model have been successful in other African countries such as Kenya where small-scale holders of the coastal region have for many years supplied Mombasa with milk. The marketing of milk from traditional herds close to centres of consumption has been accepted as part of development strategies in Malawi. (Bessell and Daplyn 2007; Agyemang and Nkhonjera 2010; Walshe 2012).

1.4 Macro environmental analysis of the dairy industry in Zimbabwe

Koumparoulis (2013) defines the macro environment as the major and external uncontrollable factors that influence an organizations' decision making and affects its performance and strategies. Such factors include the economic factors, legal, political, demographics, social conditions, technological changes and natural factors. The macro environmental analysis of the dairy industry in Zimbabwe can also be explained along the same lines. This is a strategic framework for understanding external influences on the business (Talamini*et al*., 2013). By understanding these external influences, organizations can maximize opportunities and threats (Koumparoulis, 2013).

1.4.1 Political factors

The number of large and medium scale dairy producers continued to decline from 224 at the start of 2010 to approximately 120 in 2012. This dramatic reduction can be attributed to the land reform policy, which led to the involuntary departure of several white commercial farmers off their land and resulted in widespread slaughter of dairy

animals. In 2000, the government embarked on a land appropriation programme in which nearly all 4500 white-owned commercial farms where forcibly appropriated (Richardson, 2005). The livestock slaughter and exit of many farmers from production contributed to the general reduction of the national herd, which has been the base for dairy production in Zimbabwe (Land O' Lakes, 2012). As a result foreign direct investment started whittling down from US$400 million to US$30 million between 1998 and 2007 and financial institutions began shying away from the newly settled farmers making credit access virtually impossible (Chengu, 2009).

Currently, land tenure and security of tenure has made many farmers reluctant to invest and expand their operations as they have no knowledge of how long they will be on the farms. Since the inception of the land reform programme a new crop of inexperienced farmers has since replaced experienced farmers. This has posed a negative impact on milk production in Zimbabwe (Marecha, 2009).

1.4.2 Economic Factors

Against a background of negative macroeconomic growth, high inflation, high unemployment, massive foreign exchange shortages, price controls and overvalued currency, the Zimbabwe Government in 1990 removed its socialist-guided principles to pursue a free-market economy. The performance of state-owned enterprises was critically examined. It was realized that they were not viable and weighed heavily on the fiscus (Mandiwanza, 2000). The Economic Structural Adjustment Programme (ESAP) saw the privatization of the Dairy Marketing Board (DMB) in 1995 and new entrants into milk processing being registered (Marecha 2009). This move saw the development of a

competitive dairy industry serving the needs of consumers and augmenting economic growth.

The Economic Structural Adjustment Programme was launched in 1990 based on a policy framework paper which was jointly prepared by the World Bank, International Monetary Fund and Government of Zimbabwe. It was prompted by a curtail of events- a low investment ratio which was 20 percent of the Gross Domestic Product (GDP), a drop in savings ratio from 23 percent in 1980 to 14 percent in 1990, negative public sector saving and over-reliance on the Reserve Bank of Zimbabwe (RBZ) for domestic financing which fuelled inflation. The purpose of ESAP was to restore macroeconomic equilibrium and GDP growth with the hope that the resultant new policy environment would promote private sector initiatives and thereby spur growth (African Development Bank Group, 2005). It was meant to herald a new era of modernized, export-led and competitive industrialization (Saunders, 2004).

Zimbabwe has experienced ever-transcending levels of hyperinflation with the highest peak experienced in November 2008 with a monthly rate of 80 billion percent. The country experienced a break-up in its per capita GDP which tumbled from 1997 to 2002 with an average of US$720 to about US$265 by 2008. Having grown at an average of four percent in the 1980s and 1990s, Zimbabwe's GDP contracted by 40 percent between 2000 and 2007 and 48 percent by the end of 2008. Formal unemployment rose to 60 percent (Biti, 2009b). This plethora of events led to the gradual decay of the dairy industry in Zimbabwe.

In February 2009, TendaiBiti the newly installed Minister of Finance acknowledged in his first mid-term budget that the Zimbabwe dollar was no longer a currency that the public and any trader would accept. The national currency had become moribund. The Zimbabwe dollar was officially suspended on April 12 2009 as legal tender (Biti 2009a). According to Bogetic (2000) and Chang (2000), dollarized systems promote exceptional monetary and price stability. In Zimbabwe, prior to the dollarization the country's independent monetary policy came with instability and a currency whose value was cut by half every 24 hours (Hanke and Kwork 2009). Dollarization was therefore viewed as a tool that protected the wealth of dairy farmers and increased investor confidence in the sector.

However the industry is said to have enjoyed a brief spell of dollarization as the current liquidity crunch has resulted in the manufacturing sector back-sliding. The economy has been riddled by macroeconomic uncertainties comprising amongst others, exchange rate fluctuations, high costs of debt servicing and high input costs. Due to these constraints, the industry as a whole is operating at below eight percent of installed capacity, hence the closure of several of the Dairiboard Zimbabwe Private Limited (DZPL) plants. Several smaller plants, however, are operating between 30 to 80 percent of installed capacity. According to the company's 2013 Annual Report, 2013 revenue declined to US$100.1 million from US$106.9 in 2012. This was as a result from a decline in consumer spending and fierce competition from cheaper imports.

The industry is currently restructuring to meet the local demand, with an estimated six million litres of imports, mainly from South Africa and Zambia, supplying the shortfall in demand (Land O Lakes, 2013).

Milk sold through the informal sector is of lower quality than milk that channels through the formal sector and it costs more. Informal sector milk prices range from US$0.70 to US$1.00 per litre, compared with the formal sector basic milk price of US$0.45 to US$0.50 per litre. The market varies in some regions as milk supply increases; when supply outweighs demand, the price of milk can dramatically fall to below thirty cents per litre (Land O' Lakes, 2013).

1.4.3 Social Factors

Rural to urban migration by able bodied young men and women has resulted in small – scale dairy farms being manned by the older generation who lack manual capacity. Hence efficiency of farm activities such as fodder production, animal husbandry and transportation are compromised.

1.4.4 Technological Factors

According to the Dairy Services Act (2013) milk should not contain less than three percent fat and be free of foreign bodies and contamination and hence producers on a monthly basis are required to send milk samples for testing to the Dairy Services Department in the Ministry of Agriculture, Mechanisation and Irrigation Development. Most of the processing companies require specific standards in the milk purchased. The constrained funding of the department has meant inadequate and lagging technologies. As a result, Kefalos (a processor), for example, has been sending milk samples to South Africa. (USAID, 2010). This has resulted in inconsistencies in quality checks of smallholder milk affecting the end price of the product.

Dairy farming technologies such as forage equipment and milking machines are expensive and therefore not affordable to a small-scale producer. The large capacity of machines available on the market also does not match small scale production.

Electricity outages have posed a great threat to the cold chain which is key to any dairy business. The chilling of raw milk is required on-farm or at the milk collection centres. To cope with the high ambient temperatures which cause milk and dairy products to spoil quickly, the dairy industry has to operate a cold chain. The use of back-up generators for prolonged periods has resulted in high costs of production. Areas such as Wedza small-scale dairy scheme in Mashonaland East have great potential in terms of dairy production. However, because the area is not electrified, farmers have to travel long distances of up to 25 kilometres to access the nearest bulking point. Time consumed delivering low volumes of milk have discouraged many prospective dairy farmers from venturing into the business (Land O' Lakes, 2012).

Poor road networks and widely spaced farms have also discouraged small-scale dairy farmers from seriously growing their businesses. However, farmers have adopted low cost technologies such as donkey and bicycle transportation to deliver their milk to the nearest bulking point (Land O' Lakes, 2013).

1.4.5 Legal Factors

To safeguard public health the Dairy Act and Regulation were put in place. The purpose of the Act is to consolidate and amend the laws relating to the regulation and control of the Dairy Industry to ensure that dairy produce is pure, wholesome and unadulterated (Dairy Services Act, 2013). The Dairy Act of Zimbabwe regulates the dairy industry milk

and states that producers have to be registered and certified by the Dairy Services, a unit within the Department of Livestock Production and Development. Prior to inspection, the Chief Dairy Officer issues a certificate that has to be renewed annually (Marecha, 20009).

1.5 Competitive Analysis of the Dairy Industry in Zimbabwe

Talamini et al. (2013) defines an industry analysis as a market analysis tool designed to provide a business with an idea of the complexity of a particular industry. It further illustrates industry analysis as involving a review of the economic, political and market factors that influence the way the industry develops. Major factors may include the power wielded by suppliers and buyers, the condition of competitors and likelihood of new market entrants. Porters Five Forces Framework for industry analysis has been used (Porter, 2008).

Michael Porter's Competitive Forces Model (Porter, 2008) is a structural frame of competitive forces that collectively determine the profitability and hence attractiveness of an industry. According to Porter (2008, p.15), 'for a competitive strategy to be effective, it takes offensive or defensive action in order to create a defendable position against the five competitive forces'. The collective strength of the five forces is based on structural features which collectively impact profit potential and hence the strongest become crucial from the strategy formulation point of view. These forces are rivalry amongst firms, bargaining power of buyers, bargaining power of suppliers, barriers to entry and the threat of substitutes (Cafferky, 2005). The framework provided by Porter explores the economic factors that affect the profits and prices resident in the industry. It

systematically and comprehensively applies economic tools to analyse an industry in depth.

1.5.1 Rivalry amongst firms

The Zimbabwean dairy industry faces 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. The prevailing low incomes will result in consumers opting for cheaper imports.

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.

1.5.2 Bargaining power of buyers

In Zimbabwe the prices paid to farmers by 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. Prices are adjusted when there are significant movements on the prices of inputs (USAID, 2010). However the supplier (farmer) has limited say in the determination of the milk price, hence their bargaining power is low against that of the buyer (processor).

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 of 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. Processors such as DZPL, Nestle and Kefalos pay producers a quality premium, while the processor Kershelmar suspended the quality premium and pays all producers a flat rate for milk delivered.

1.5.3 Bargaining power of suppliers

The National Dairy Cooperative (NDC) offers bulk milk transportation to farms and MCCs through a fleet of tankers. The farmer generally pays the cost of transporting the milk to the processor, however this depends on the contract with the processor. The current shortage of milk has led processors to provide transport subsidies. DZPL purchased its own fleet of tankers that collects milk from farms and MCCs. Such a move has significantly impeded on the viability status and bargaining power of the NDC as a transportation service provider as most of its routes have been taken over.

Finance for input markets is currently not available for small-scale dairy producers at competitive interest rates. This will enable small-scale farmers to access inputs such as artificial insemination services, vaccines, veterinary drugs and antibiotics that are necessary to improve the quality of the milk supplied to the market and hence improve incomes and production.

1.5.4 Barriers to Entry

The potential for growth in the industry exists given that companies are currently unable to satisfy local demand. Most of the companies are operating below capacity, with DZPL, for example operating at 35 percent capacity. Keshelmar dairy has annual volume requirements of eight million litres of milk but is currently able to source close to four million litres. Kershelmar Dairy used to have a depot in the capital, Harare, but this has been closed down due to lack of supplies. DZPL has closed some of its factories including the Kadoma cheese plant and the Chitungwiza powder and butter making plant due to limited milk supply. The current short fall of milk is being met through imports, which are currently getting into the country duty free as part of the waiver of duty on imported food products (USAID, 2010). Hence barriers to entry into the industry are low.

1.5.5 Threat of substitutes

The threat of substituting milk in Zimbabwe has been low. Identified substitutes of milk from a dairy cow include soya and rice milk which are not common products in Zimbabwe. These products are favourable for lactose intolerant categories and vegeterians.

1.6 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.

1.7 Research Objectives

The objectives of the study were:

- to estimate the economic viability of Marirangwe and Chikwaka small-scale dairy farms;
- to establish the relationship between costs of production and gross income for small-scale dairy production farms in Marirangwe and Chikwaka;
- to determine the non-monetary factors influencing gross income of small-scale dairy farming units in Marirangwe and Chikwaka;
- to determine the factors influencing the marketing of milk and milk products from Marirangwe and Chikwaka small-scale dairy farmers.

1.8 Research Questions

1.8.1 How economically viable are the Marirangwe and Chikwakadairy production units in terms of profitability, asset utilization and adequacy of returns to investors?

1.8.2 Is there any significant relationship between production costs and gross income in Marirangwe and Chikwakasmall-scale dairy units?

1.8.3 What non-monetary factors affect gross income of small-scale dairy farming units in Marirangwe and Chikwaka?

1.8.4 What factors influence the marketing of milk and milk products from small-scale dairy farms in Marirangwe and Chikwaka?

1.9 Hypothesis

1.9.1 Small-scale dairy farms in Marirangwe and Chikwakaare not economically viable.

1.9.2 There is no relationship between costs of production and gross income for small-scale dairy farms.

1.9.3 Gross income is not influenced by non-monetary factors

1.9.4 There are no factors affecting marketing of milk and milk products

1.10 Justification

The justification of this study is that a larger and more competitive dairy industry has the potential to raise prosperity especially in Zimbabwe's small-scale dairy farms. It has the potential to provide greater and more regular revenue for Zimbabwe as a country and contribute to exports and diversification.

Small-scale dairying has foreseen increases in Zimbabwe's milk production base, improvement in household nutrition, empowerment of women and youth in income generation ventures and agricultural development. It assists farmers diversify, spread farming risks and creates opportunity to make idling resources like crop residues enter the human food chain utilizing marginal form resources (Topps and Ngongoni2012: personal communication).

This research will not only identify factors affecting the economic viability status of small-scale dairy farming in Zimbabwe, but it will also recommend strategies that will see these units growing into economically viable businesses and hence a turnaround of Zimbabwe's dairy industry.

1.11 Scope of the Study

The study is confined to small-scale dairy farming units in Mashonaland-East province of Zimbabwe during the post-independence era.The research respondents are drawn from Marirangwe and Chikwakadairy development projects.

1.12 Limitations of the study

The study was limited to establishing the economic viability status of small-scale dairy farmers in Marirangwe and Chikwaka in Mashonaland-East Province. However, had time not been a constraint, the researcher would have wanted to pick more provinces in Zimbabwe and establish the differences in economic viability status of small-scale dairy farmers by geographical region and settlement type.

1.13 Dissertation Summary

The rest of the dissertation is made up of four chapters. Chapter Two, the Literature Review, gives a critical review of existing research that is significant to the work that has been carried out. Chapter Three, the Research Methodology, seeks to demonstrate the methodology that will be used in the research and the research methods literature which has informed the researcher's choice of methods. Chapter Four presents the Results of the study. Lastly Chapter Five closes with Research Discussion, Conclusions and Recommendations.

1.14 Chapter Summary

As discussed in this chapter, Zimbabwe's dairy industry has been hard hit by various macro environmental factors that resulted in its near collapse and hence it is currently in a rebuilding phase. It is clear that with the exodus of large scale dairy farmers following

the land reform programme (Hanyani-Mlambo, 2000) the small-scale dairy sector plays a key role towards the growth of the dairy sector in Zimbabwe. This study seeks to explore the growth prospects of the dairy industry in Zimbabwe with special emphasis having been placed on the economic viabilityof small-scale dairy farmers in Zimbabwe. A multiple case-study approach shall be used reaching out to small-scale dairy farmers situated in Zimbabwe's Mashonaland East province.

CHAPTER 2

2 LITERATURE REVIEW

2.0 Introduction

This chapter reviews the current literature on dairy farming, with particular emphasis on small-scale dairy farms. It also looks at the economic viability of such farms in Southern and Eastern Africa.

2.1 Meaning of viability

Luin (2002) defines the concept of viability as a firm's expected rate of return. The author establishes that a normally managed enterprise is expected to earn a socially acceptable normal profit in an open, free and competitive market without any external subsidies or protections. This enterprise is said to be viable.

Johnson (2003) states that in developed countries enterprises are regarded as viable. Except for a few minor sectors, governments in these countries rarely give subsidies or other forms of support to these enterprises. Djankov (2002) stipulates that in developing countries several enterprises do not earn acceptable profits and are therefore not

viable. The author relates this to whether the sector in which the enterprise operates, technological choices at play and products it produces are consistent with comparative advantages determined by factor endowments such as the relative abundance of labour, capital and natural resources in that particular economy.

Paul (2001) therefore stipulates that the viability of a firm in a competitive market is dependent on whether the choice of technology rests on the point of least cost as determined by the relative availability of production factors in the economy. If this is not the case the enterprise is not viable and therefore cannot survive without government subsidies and support.

TheAustralian Skills Quality Authority (2013), has defined viability as the ability to survive. The ability to survive is ultimately linked to financial performance and position.

A business is viable where it is either:

- Returning a profit that is sufficient to provide a return to the business owner while also meeting its commitments to business creditors.
- It has adequate cash resources to uphold itself through a period when it is not returning a profit.

Very Yard Projects (2005) ties up the above mentioned definitions by stating that the simplest notion of viability is that a business is operating at a profit. He further introspects and relates that a business is viable if it is expected to make a profit one day. Hence it must either reach breakeven before funding runs out or investors must be

willing to provide further funding. On the contrary, a business that is currently viable may have an uncertain future.

Crowther and Aras (2009) view economic viability as a component of sustainability and define it as an adequate return for the level of risk undertaken. Yefremova (2009) examines the concept of economic viability as involving interconnectedness with terms such as balance, stability and development.Tsabedze (2012) builds on already existing assertions of an economically viable business as one that meets its operational and financial obligations and is able to sustain itself.

Lui (2002) refers to economic viability as the earnings from farming operations, relative to the farms asset worth and labour inputs being competitive with other small business, career or investment alternatives. The Asian Development Bank (1999) defines economic viability as the recovery of costs, provision of additional required rate of return and sustenance of effective production in the face of uncertainty and risk. The economic analysis of a project assesses its overall impact on the economic welfare of citizens of the country concerned. An assessment of the project is therefore from a national context rather than a project context.

The authors are certainly in agreement that the concept of economic business viability ties up profitability, survival, sustainability and continuity. A culmination of ideas around the concept of economic viability by the different authors has led me to conclude by defining it as firstly ‘the distribution and use of a company’s financial resources which allows it to sustain a state of equilibrium in the short term and sustainable development in the long-term’, andsecondly, ‘public profitability comprising positive economic

resource flows, an increase in output and effective production in the face of risk and uncertainty'.

2.2 Measures of economic viability

The Asian Development Bank (1999) stipulates that the economic analysis of a project estimates the return accruing to the project operating entity and/or project participants and measures the viability of the project on the national economy. 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. Henceforth, financial and economic analysis are therefore complementary and therefore two sides of the same coin.

According to an analysis done by a number of scientists there is no unanimity pertaining to indicators or methodologies most suitable to measure economic viability of agricultural holdings. This is usually a matter of difference of opinion (Scott et al, 2008; Popelier, 2005; Koleda et al, 2005)

For the determination of relative profitability, the gross margin calculation has been recommended as one such measure for farm enterprises (GRDC, 2013).Rushton et al (2009) articulates that it is a tool used to evaluate the economic viability of an enterprise. The gross margin analysis involves determining all variable costs and revenue associated with an enterprise. The gross margin for the enterprise is calculated as the difference between revenue and total variable costs (GRDC, 2013) , commonly expressed as output per standard and a measure of the contribution of that enterprise to farm profit Rushton et al (2009).

As a way of determining enterprise profit, Rushton et al (2009) stipulate the use of an enterprise budget. It is defined as the enterprise output less fixed and variable costs or simply the enterprise gross margin less fixed costs. The authors further argue the use of the gross margin and enterprise budgets as they are useful for enterprise comparisons and assessing enterprise productivity and hence the selection of the best combination of enterprises. A recommendation put forward by Dent et al (2010) is that the selection of enterprises for a farm system is determined by the highest gross margin. Dent et al (2010) further stipulates that the gross margin analysis technique is useful for farming systems where quantitative enterprise data is available and profit maximization is a primary motivation.

Rushton et al (2009) identify a shortcoming of the use of gross margin and enterprise budget analysis as the fixed nature of prices and outputs.It searches for the yield or price that will return a zero gross margin. An enterprise is relatively robust where the break-even is below the lowest possible value and robust where the break-even price is above the highest possible value.

The authors (Rushton et al, 2009), make mention of partial budgeting which is a form of marginal analysis reflecting the increase or decrease in net farm income resulting in proposed changes and not the profit or loss of the farm as a whole. It is based on expected values and is often used as an evaluation tool in estimating economic impact. They are concerned mainly with new costs, revenue foregone, costs saved and new revenue.

Slavickiene et al (2014) stipulate the use of relative financial ratios as the simplest way to assess the economic viability of agricultural enterprises. These are categorized as profitability, short-term and long-term solvency, capital efficiency and capital market ratios. Koleda et al (2009) pinpoint five main ratios, return on sales ratio, debt to equity, interest coverage, return on assets and return on investment as measures of economic viability of agricultural holdings.

The Australian Skills Quality Authority (2012) also recommends specific measures to assess economic viability. Net Tangible Assets; Working Capital Ratio; Current Ratio; Debt Ratio and Profitability. The Australian Skills Quality Authority defines net tangible assets as representing the amount of physical assets less liabilities present in a business. They go on to define the working capital ratio as a measure of whether a company has enough short term assets to cover short term debt. Lastly, they ascertain that the current ratio gives an indication of a company's ability to meet short-term debt obligations.

Koleda and Lace (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 further argue that sales price, production volumes, expenses and decision making comprise the greatest impact on economic viability of an agricultural enterprise. Assessment methodologies by Tobraegel (1998) and Argiles (2001) rely on indicators of production costs, performance and financial position. Their indicators describe the financial position comprising ratios of material investment, return on equity, and total output and production subsidies to costs.

2.3 Factors affecting the viability of smallholder dairy farmers

Studies carried out by Mumba et al (2011) have indicated that education levels, dairy cow herd size and distance to the market significantly affect the profitability of small-scale dairy farmers in Zambia. Findings from the study also established that an increase in education levels, cow herd size and a unit decrease in distance to the market led to an increase in the profitability of small-scale dairy enterprises.

In Mumba's study, a unit increase in the herd size of milking cows resulted in profit increase of the small-scale dairy enterprise. In terms of access to markets, a unit decrease in distance to the milk collection centre also leads to an increase in profit. The viability of an enterprise is hindered by long distance (Mutukumira et al 1996). The number of smallholder farmers delivering to milk collection centerslessen with an increase in distance. In this study, marital status, household size and age had no significance on the profitability of the smallholder dairy enterprise.

According to Ngongoni et al (2006), the size of a household was described as one of the most important determinants of labour investment for small-scale dairy farms. Firstly as a source of labour and secondly as an influence for increased milk production for home and market consumption.

In the study conducted by Ngongoni et al (2006) in Zimbabwe, poor performance of small-scale dairy farmers relating to low milk yields, low calving rates, late age at first calving and long calving intervals were observed and attributed to low levels of nutrition and management. The limited availability and high cost of concentrates has resulted in declining milk to concentrate price ratio which makes it difficult for small-scale dairy

farmers to feed adequate concentrates regularly. This has resulted in low productivity and subsequently low profitability of dairy enterprises. Hence the decline of milk price to concentrate ratio has caused a decline in viability of dairying.

Tsabedze (2012) outlines a number of factors that affect the economic viability of small-scale dairy businesses:

- investment costs;
- operational costs;
- production levels;
- market;
- management team capacity;
- social cohesion;
- turnaround time;

According to Chantalakhana (1995a) factors such as unfavourable government policies, lack of market outlets and inefficient dairy extension services have resulted in low productivity and relatively poor financial performance of small-scale dairy farmers. Chantalakhana goes on to categorise these factors into technical support, institutional support, government policies and the farmers' socio-economic factors.

2.4 Economic viability of smallholder dairying in African countries

It is pertinent to review work done by other researchers on financial and economic viability as it directly relates to small-scale dairy farming. A number of studies have been undertaken to assess the financial and economic viability of small-scale dairy farming in

Africa. Most researchers have used the gross margin analysis as a tool for determining the efficiency and profitability of dairy systems. Regression analysis has also been used to determine the factors affecting these systems (Cain et al, 2007).

2.4.1 The economic viability of small-scale dairy farming in Zimbabwe

In the last five years only one study has been published on the viability of small-scale dairy farming in Zimbabwe. This study led by Zvinorova (2010), was conducted on the 'viability of smallholder dairying in Wedza, Zimbabwe'.

The researcher postulates that differences in viability amongst small-scale dairy farmers are as a result of differences in access to markets and services. The study puts forward a hypothesis that stipulates that improved returns and viability are as a result of innovations that improve productivity and market linkages. It was targeted at Wedza small-scaledairy farmers who are located in Mashonaland East Province of Zimbabwe.

A gross margin analysis was conducted with and without family labour. Focus was on poor and resource rich farmers. Results of the study indicated that the usage of family labour was higher in farmers who are poorly resourced as compared to other farmers. Hence adequately resourced (rich) farmers had better profitability figures than farmers in other categories. Gross margins decreased with an increase in variable costs. However, the difference between Zvinorova's study and the current is that it tries to establish the relationship between costs of production and gross income and the influence of gross income on non-monetary factors.

Results of the study also revealed that the ratio of operating costs on income resulted in expenditure incurred on milk production not being economically cost effective. Negative returns per cow were experienced by most households.

There was a positive correlation ($r=0.8$; $P<0.05$) between gross margins and the number of milking animals that farmers should keep to remain profitable. The study hence concluded that small-scale dairying in Wedza was not viable. Poor management attributed to the losses incurred by farmers located within the proximity of the market (Milk Collection Centre). Highly resourced farmers enjoyed higher returns on feed costs. High economic performance of dairy farming was found to be dependent on the number of lactating cows owned by the farmer and hence resource rich farmers enjoy such benefits. Farm specific variables such as experience, high levels of education and large farm sizes were found to result in increased efficiency and hence a higher chance of the farm operating profitably. The results of the study also revealed that the acceptability and adoption of technology is dependent on socio-economic factors such as family size, gender of the head of the house-hold and distance from the market. In conclusion, the study postulated that the scope for increasing profitability and productivity was as a result of an increase in herd size and improved efficiency.

From the study, one would put forward a hypothesis that postulates that the financial viability and growth potential of small-scale dairy farming in Zimbabwe is a measure of productive efficiency and proximity to markets.The researchers where limited to profitability ratios, whereas they could have also analyzed capital efficiency ratios such as dairy investment per cow and asset turnover (Shoemaker et al, 2008). The dairy investment per cow allows one to measure the efficiency of the money invested in the

dairy farm and the asset turnover ratio measures the efficiency by which all farm assets generate revenue (Shoemaker et al, 2008).

2.4.2 The economic viability of small-scale dairy farming in Zambia

In a research done by the World Bank in 2011 it emerged that small-scale dairy farmers are more competitive than commercial farmers. Small-scale dairy farmers were reported to be able to use the natural advantage of grazing land and portray greater efficiency than their commercial counterparts. These farmers were said to combine aspects of both traditional and commercial farmers. However, they reflected a shift in attitude in that their cattle were viewed more as a source of revenue than a social asset. A gross margin analysis was conducted to review the financial performance of the two sectors.

Results from the gross margin analysis showed that a small-scale dairy farmer is able to achieve a good yield for a cross bred cow of tenlitres per day and should be able to earn over US$3,000 a year representing a good return on the cost of buying it. From the research conducted by the World Bank, with the current price of sixty cents a litre, a commercial farmer with 100 cows yielding 23litres a day each is able to produce raw milk at the cost US$0.57 perlitre, three times the cost of a small-scalefarmer who incurs US$0.18 per litre.

It emerged that feed costs account for the major proportion of raw milk production costs the world over. It is therefore the lower cost of feed that has made emergent small-scale farmers more efficient and competitive. Whilst the commercial farmer spends US$0.32per litre on feed alone under a system of zero grazing, purchased feed

accounts for nearly half the total cost of commercial production. Commercial farmers who are in a position to mix their own feed would certainly be more competitive.

However a small-scale farmer spends US$0.09 per litre on feed. This is closely in line with costs in Kenya which were estimated at US$0.07 in 2008 (Technoserve, 2008). Given the analysis above, the writers of this report pose the question, if the small-scale farmer is so much more competitive, why commercial farmers should not adopt these best practices?

A shortcoming of this study is that it did not explore best practices from commercial counterparts and how small-scale farmers can adopt key lessons and grow into the large commercial scale in order to take advantage of economies of scale. Although their cost structures are high, commercial dairy farmers have achieved herd sizes that are much larger, yields close to 17 to 23litres per cow per day, calving rates that are pegged at 70 to 80 percent and calving mortality rates as low as one to two percent (World Bank, 2011). In Zambia, small-scale dairy farmers were faced by a number of constraints which limitedtheir growth potential. The cost of disease prevention was high as animals were exposed to various diseases when they are out grazing (Chemonics International Inc, 2004). The high cost and limited access to finance were highlighted in the World Bank Report as a major constraint. Capital was required to invest in breeding animals, growing fodder crops, improving pastures and hay making. The study does not furnish readers with a comparative analysis of the gross margins between the two sectors, but feed costs which are only one component amongst a diverse range of costs structures. Just like the Zimbabwean study, the research is not exhaustive of economic viability ratios as they are not only limited to profitability.

Based on the findings of this research, one would put forward a hypothesis that the economic viability of small-scaledairy farmers is a function of efficiency of available feed sources.

In a study conducted by Mumba et al (2011), the objective was to assess cost of production and profitability. Mburu 2007, stipulates the importance of measuring cost of production as it establishes the profitability levels of the farmer. To estimate the cost and returns of small-scale dairy enterprises, a gross margin analysis was undertaken with use of only variable input costs. However, fixed costs were ignored as they were unrelated to higher levels of milk production and do not affect the optimal combination of variable inputs (Mburu et al, 2007).

2.4.3 The economic viability of small-scale dairy farming in Kenya

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. The gross margin served as the unit of analysis in evaluating the economic performance of an enterprise.

In the study, small-scale farmers were defined as owning an average two to three cows. In Kenya, the dairy production systems were subdivided into four broad categories comprising zero grazing, semi zero grazing, tethering and open grazing.

In the study, the average number of dairy cows and lactating cows was two and three respectively across the sample. Average milk yields are higher in the zero grazing system at 436 litres per lactating cow per month as compared to the non-zero grazing

systems where the milk yields average 393 litres per lactating cow per month. Land input per dairy cow was comparatively lower in the zero grazing than the non-zero grazing system. However, labour costs per lactating cow were higher in the zero grazing than the non-zero grazing system.

In the study, cost structures comprised mainly bought in concentrates and fodder, salt lick and minerals, maintenance and repairs, consumables (milking jelly and fuel), water and electricity, veterinary and insemination, hired labour and milk transportation. These were calculated using market prices. However, the cost of on-farm produced fodder was calculated using cost of hired labour and purchased inputs used in production.

Results from the study indicated that the purchase of concentrates formed the largest cost component amongst households practicing zero grazing and non-zero grazing systems. More labour was required in the non-zero grazing as there was minimal confinement as compared to the zero grazing system.

The results also revealed that the total value of milk produced by each lactating cow proved to be higher in the zero grazing system. The value of milk in the zero grazing system on average was US$72.76 compared to US$62.02 in the non-zero grazing system. However, the households practicing the zero grazing systems incurred higher monthly variable costs per lactating cow (US$61.61), as compared to US$43.25 for the non-zero grazing systems. Accordingly, the gross margin in the zero grazing system proved to be lower, with a monthly return over variable costs of US$18.77.

Therefore consequently, the gross margin to variable expenses was significantly lower for all households regardless of the grazing system. This is indicative of the fact that

every dollar invested in total variable costs gave a return of just a few cents. Further introspection revealed that the gross margin rate was lower on average, but higher for non-zero grazing systems.

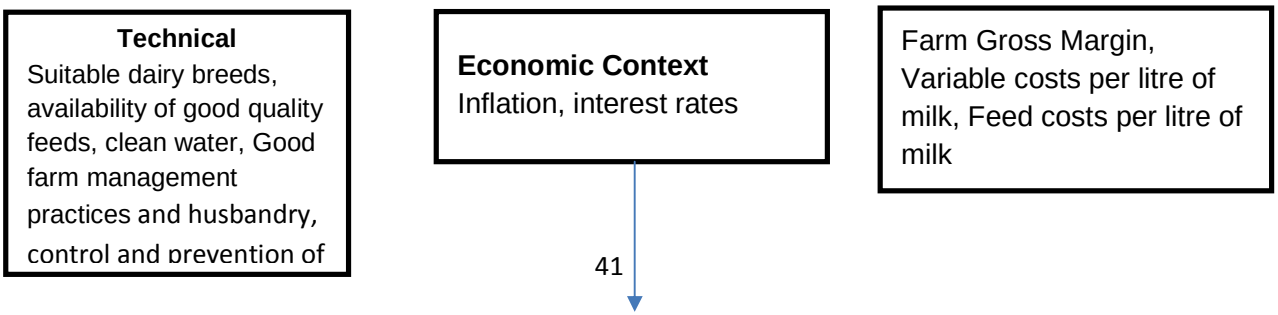
Ultimately the results showed that a larger proportion of revenues in the non-zero grazing system were available for covering fixed costs of land, labour, capital and the farmers profit. Performance measures indicated that the pasture based enterprises are more profitable than the zero grazing enterprises. Small-scale dairy farming in Kenya is economically viable on the whole.

Osotimehin (2006) examined the profitability and operational efficiency of a milk processing enterprise in Kogi Estate. In calculating the economic efficiency of small-scale dairy cattle in Kenya's marginal zones, Kavoi et al (2010) selected the cost function approach. This was in an effort to avoid challenges of estimation that arise in situations where farm households realize zero or negative profits at the prevailing market prices. Otieno et al (2009) used farm level profits generated by gross margin analysis in order to compare relative efficiency in dairy farming.

2.5 Contextual Framework

The conceptual framework was derived from findings of authors reviewed and is applied to the Zimbabwean context.

Independent variablesModerating VariablesDependent Variables



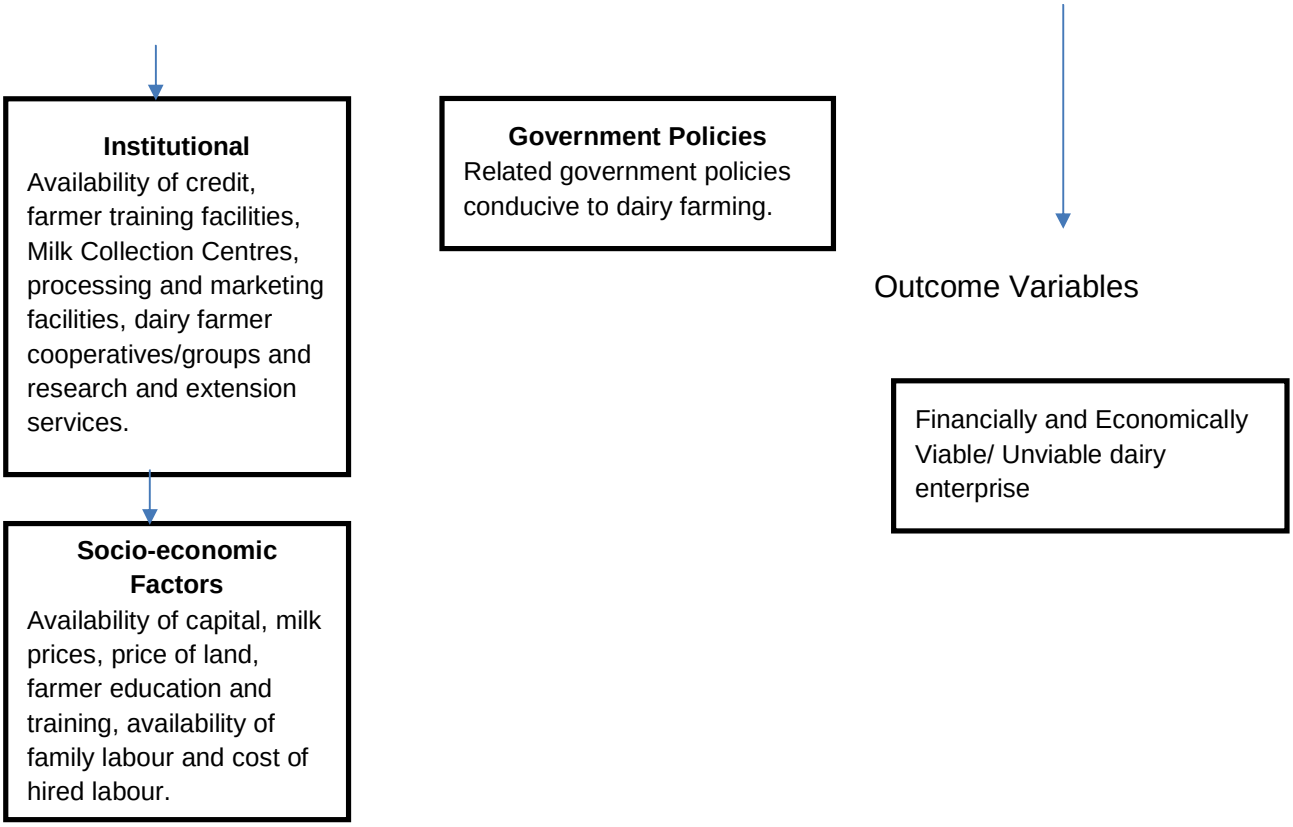


Figure 2. 1 Contextual Framework

It is clear that a number of factors affect the economic viability of small-scale dairy farming in Zimbabwe. These have been categorized as independent and moderating variables. The independent variables directly affect the rate of return of enterprises and hence further broken down into technical, institutional and socio-economic factors. They all affect the viability of a dairy enterprise at different levels. The economic context and government policies of the country were identified as moderating variables as they mediate between the independent and dependent variables.

The outcome of the dependent variables such as farm gross margin, variable costs per litre and feed costs per litre are determined by the state of independent variables such

as suitability of dairy breeds, availability of credit and milk prices just to mention a few. The hypotheses that was tested in this study is that small-scale dairy farms in Marirangwe and Chikwaka are not economically viable, there is no relationship between costs of production and gross income, gross income is not influenced by nom-monetary factors and there are no factors affecting the marketing of milk and milk products of small-scale dairy farmers. The study therefore attempts to establish the current economic viability status of small-scale dairy farming units in Zimbabwe, factors affecting the viability status and investigates ways in which it can be improved.

2.6 Gaps in Literature

A number of gaps were identified in the literature under review. Particular emphasis was be placed on the case-study reviews.

A shortcoming of the Zambian, study is that it did not explore best practices from commercial counterparts and how small-scale dairy farmers can adopt key lessons and grow into the large commercial scale in order to take advantage of economies of scale. Although their cost structures were high, commercial dairy farmers achieved herd sizes that are much larger, yields close to 17 to 23litres per cow per day, calving rates that are pegged at 70 to 80 percent and calving mortality rates as low as one to two percent (World Bank, 2011). In Zambia, small-scale dairy farmers were faced by a number of constraints which limited their growth potential. The cost of disease prevention was high as animals were exposed to various diseases when they were out grazing (Chemonics International Inc, 2004). The high cost and limited access to finance were highlighted in the World Bank Report as a major constraint. Capital was required to invest in breeding animals, growing fodder crops, improving pastures and hay making. The study does not

furnish readers with a comparative analysis of the gross margins between the two sectors, but feed costs which are only one component amongst a diverse range of costs structures. Just like the Zimbabwean and Kenyan study, the research was not exhaustive of measures of economic viability as they are not only limited to profitability.

It is apparent in all case studies, that a gross margin analysis was used to review the economic viability of small-scale dairy farming. Kaitibie (2008) defines a gross margin as the difference between the value of an enterprise's gross output and variable costs of the enterprise which vary with the size of production. The gross margin analysis provides the viability of the enterprise. However the economic viability of the business is not just limited to profitability ratios. The economic viability of small-scale dairy farming can also be measured by the proportion of a company's equity used to finance its assets (debt-to-equity), or the return on assets as illustrating efficiency in employing total assets to make a profit (IMF, 2006). Capital efficiency ratios (Shoemaker et al, 2008) and liquidity ratios (Australian Skills Authority, 2013) are also used as measures of farm economic viability.

The case studies after the release of findings (viability/non-viability) do not explore strategies that could lead towards changing or improving the situation of the small-scale dairy farmers. In the case of small-scale dairy farmers, growth is a key component which is a function of increased production capacity, revenue and the number of jobs created. The potential of growing the farmers progressively from small, medium to large scale have not been explored.

2.7 Chapter summary

As discussed in this chapter, farm economic viability is a culmination of profitability, survival, sustainability and continuity. Studies on the financial and economic viability of small-scale farmers were carried out by a number of authors and institutions Hanyani-Mlambo (2000); Osotimehin (2006); Kavoi (2010); Zvinorova (2010); World Bank (2011); Mumba et al (2011); Tegmes Institute of Agricultural Policy and Development (2011). The researchers are in agreement that this sector is either unviable or at the mercy of very low margins. A number of constraints faced include low calving rates, low levels of nutrition, poor management and distance from the market.

CHAPTER 3

3 METHODOLOGY

3.0 Introduction

This chapter section seeks to demonstrate the methods, instruments and analysis used to ascertain the economic viability of small-scale dairy farmers in Marirangwe and Chikwaka Milk Producer Associations (MPAs).Both quantitative and qualitative techniques, structured questionnaires and secondary sources of data were used in this study.

3.1 Description of study site

Marirangwe small-scale dairy scheme in Seke districtis in agro-ecological zone II b and located 35 kilometers south of Harare, off Masvingo-Beatrice highway. The scheme is also located seven kilometers from Kefalos Dairy Processing Plant. Farmers in the small-scale commercial areas of Marirangwe own landholding with average sizes of 40 hectares per farm. Chikwaka communal lands in Goromonzi District in agro-ecological zone II are located 51 kilometers east of Harare and about two kilometers from Juru Growth Point. The average landholding size per farm is about 0.5 hectares. The study area is shown in Figure 3.1.

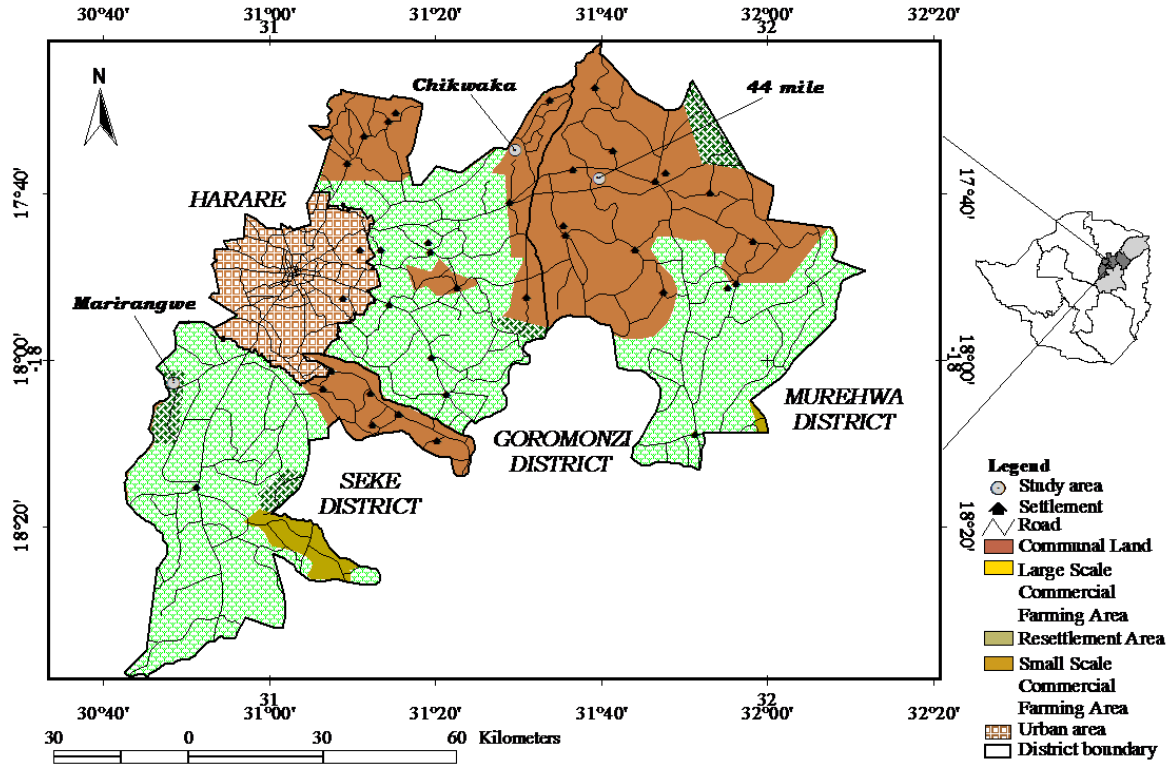


Figure 3. 1Study Area Map (Prepared by researcher using the GIS method)

3.2 Research approach

Quantitative and qualitative techniques were used to collect data although the study was more oriented towards the former. The use of quantitative data allowed comparisons of the scale of developments in Marirangwe and Chikwaka by combining figures, comparing data and examining rates of change. This allowed much greater precision, accuracy and consistency in reviewing the results of the study. Already constructed theories about how and why phenomena occur were tested and validated. A quantitative research methodology was also preferred because it looked at variables and could establish cause and effect relationships in highly controlled circumstances, for example, the relationship between costs of production and gross income of small-

scale dairy farmers. It also focused on maximizing objectivity, generalizing findings, replicability and prediction. Experiences, bias and perceptions were set aside so as to ensure objectivity in the conduct of the study, and conclusions drawn (Bryman and Bell, 2007). The use of qualitative research complemented the study as it helped the researcher discover and understand the experiences, perceptions and thoughts of small-scale dairy farmers (Denzin, 2006).

Secondary data in the form of records of existing small-scale dairy farmers in the two locations were also retrieved from the MPA records and verified with the Zimbabwe Association of Dairy Farmers' (ZADF) membership register.

3.3 Research design

The research employed a survey in Marirangwe and Chikwaka areas using structured questionnaires to collect quantitative data from small-scale dairy farmers.

3.3.1 Study population

The population of the study comprised small-scale dairy farmers in Marirangwe and Chikwaka. These are farmers who are members of a Milk Producers' Association (MPA) and are delivering milk to a Milk Collection Centre (MCC) or non-members of an MPA who produce and sell milk and milk products within the locality in which they reside. Marirangwe is predominantly comprised of small-scale commercial dairy farmers whilst Chikwaka was comprised of mainly small-scale communal dairy farmers. The number population size of small-scale dairy farmers was approximately 35 and 37 in Marirangwe and Chikwaka respectively.

3.3.1 Study sample

The research employed sample surveys in Marirangwe and Chikwaka areas using structured questionnaires to collect quantitative data from small-scale dairy farmers. Study samples from the two sites were selected through purposive sampling which only considered small-scale farmers that were members of an MPA and actively delivering milk to the respective milk collection centres. Farmers selling milk to buyers other than the milk collection centre were not included in the sample. Since the small-scale dairy farmers in the two sites were dairying under different socio-economic conditions, the factors affecting economic viability of their enterprises were also expected to differ. The two samples therefore included small-scale dairy farmers who were registered with an MPA or Cooperative in the area. Table 3.1 shows the samples from the two study sites

Table 3. 1Sample structure for Marirangwe and Chikwaka study areas

Study area	Number of farmers (sample size)	Gender of household head	
		Male	Female
Marirangwe	30	26	4
Chikwaka	33	22	11

3.3 Data collection

3.3.1 Questionnaire pre-testing

The preliminary testing of the questionnaire was done to determine the adequacy, accuracy and practicality of the designed tool. Data from the pre-test was put on trial statistical analysis before the questionnaire was modified, amended and finalized for the actual administration in the two study sites.

The desk-designed questionnaire was pre-tested among 40 households within the proximity of Marirangwe and Chikwaka. The two identified areas were Mubaira which is approximately 15kilometres from Marirangwe and Murehwa 44 area which is 20kilometres from Chikwaka. These two areas display similar characteristics with the study areas in terms of agro-ecological regions and farming practices.

3.3.2 Questionnaire administration

Two enumerators, one each from Marirangwe and Chikwaka, assisted with the administration of the questionnaire. They both were trained in questionnaire administration as well as to familiarize them with the questionnaire.

Quantitative data was collected using a structured questionnaire that was administered to the respondents in Marirangwe and Chikwaka Milk Producer Associations. A combined total of 63 questionnaires were distributed to the two study sites. The questionnaires sought information on demographic information, 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. Qualitative data was also collected through interviews with key informants, government field extension officers, MPA Chairpersons from Marirangwe and Chikwaka, a dairy specialist in the private sector and the ZADF operations manager. These key informant interviews sought information pertaining to policy implementation, financing of DDPs as well as coordination of MCC activities. In total there were two interview sets.

3.3.4 Review of secondary source documents

The review of secondary source documents was done to establish the volume and value of milk delivered to the MCCs. This information was verified with schedules delivered to the Zimbabwe Association of Dairy Farmers. Studies previously conducted on the viability of small-scale dairy farmers were also reviewed to enable the researcher to compare findings.

3.5 Calculations

From the collected data the following parameters were calculated before statistical analysis:

3.5.1 Calculation of total variable cost, gross income and gross margin

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.

3.5.2 Calculation of income ranking index

Data on sources of household income was collected by individual household ranking. The sources were then ranked by study site and a ranking index computed. Ranking sums, weighted ranks and indices were computed for each criterion in the two study areas as proposed by Mbuku*et al*. (2006):

Rank sum = Sum [proportion of farmers ranking criterion from Rank 1 to Rank 5]

Weighted Rank = Sum[(% ranking criterion 1 X 5) + (% ranking criterion 2 X 4) + (% ranking criterion 3 X 3) + (% ranking criterion 4 X 2) + (% ranking criterion 5 X 1)

$$\text{Ranking index} = \frac{\text{sum of [5 for rank 1} + \text{ 4 for rank 2} + \text{ 3 for rank 3} + \text{4 for rank 2} + \text{5 for rank1] for a particular criterion}}{\text{sum [5 for rank 1} + \text{ 4 for rank 2} + \text{ 3 for rank 3} + \text{4 for rank2} + \text{5 for rank 1] for all criteria in question}}$$

3.5.3 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. This ratio indicates how efficiently the money on a dairy farm is invested.

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

3.6 Data Analysis

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.

3.7 Chapter summary

The study on the economic viability of small-scale dairy farmers in Zimbabwe was conducted in Marirangwe and Chikwaka. Quantitative and qualitative techniques where employed. However, the study was more oriented towards a quantitative methodology. The population of the study comprised of small-scale dairy farmers and the sample was selected using purposive sampling techniques. The sample of the study comprised active members of Marirangwe and Chikwaka MPAs. Secondary data sources were also reviewed to establish the volume and value of milk delivered to the MCC. The chapter also demonstrates statistical calculations for gross margins, capital efficiency ratios and income ranking indices.

Lastly, the use of the Statistical Analysis System (SAS) Version 9.3 Package for Social Scientists (SPSS), Version 21. Data is articulated as it was used to analyse data on gender of household head, dairy breeds, marital status level of education and other demographic information. 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.

CHAPTER 4

4 DATA ANALYSIS AND FINDINGS

4.0 Introduction

This chapter presents the results of findings and data analysis. The results of the study are disaggregated by area and type of settlement comprising small-scale commercial (SCC) dairy farmers in Marirangwe and communal small-scale dairy farmers in Chikwaka. Firstly the results displayed the socioeconomic characteristics of small-scale dairy farmers in Marirangwe and Chikwaka in order to establish an understanding of the differences that may exist between the two areas.The economic viability of small-scale farmers in Marirangwe and Chikwaka was measured using gross margin analysis and capital efficiency ratios.

The effect of various cost components on gross income for the two study sites were evaluated using the multiple regression analysis of the form. Pearson's correlation coefficients were further used to determine the degree of association between costs of production and gross income. The effect of non-monetary factors on gross income for the two study sites was evaluated using step-wise multiple regression analysis of the form.Finally, from the research findings the factors influencing the marketing of milk and milk products from Marirangwe and Chikwaka small-scale dairy farmers were established.

4.1 Demographic information

Of the 63 questionnaires administered, five were spoilt achieving a 92 percent response rate. Of the remaining questionnaires, 26 and 32 questionnaires were received from

Marirangwe small-scale commercial and Chikwaka communal areas respectively. Table 4.1 shows the demographics for the two study areas

Table 4. 1Demographic 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
Marital status of H/head **(%)**:	Married	91	56
	Single	4.5	9
	Widowed	4.5	35
Highest level of education **(%)**:	Primary	4	18
ZJC/Std 6		24	48
Secondary		40	30
	Tertiary	32	4
Occupation of H/Head **(%)**:Not employed		85	91
Employed		15	9
Agric training of H/Head **(%)**:	MF	26	0
	AMF	24	6
	Diploma	5	41
Basic training		45	53
Experience in dairying (years)		10.5	5

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

4.2 Descriptive Statistics

4.2.1 Stock, production and feeding details

Table 4.2 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 4. 2Average number of cattle, daily milk production, feed consumption and land pasture

Variable	Number of respondents	Mean	SD	Min.	Max.
Number of cattle: Marirangwe	26	4	3	0	30
Chikwaka	32	2	1	0	16
Daily milk yield (l)Marirangwe	26	19	25	0	92
Chikwaka	32	4	6	0	32
Monthly feed (kg)Marirangwe	26	19	50	0	180
Chikwaka	32	190	527	0	3000
Land pasture (ha)Marirangwe	26	0.23	0.51	0	2
Chikwaka	32	15	46	0	200

4.3 Sources of income

The sources of income were ranked and ranking indices calculated as outlined in Chapter 3. Table 4.3 shows the ranking indices for the different sources of income for the household heads. In Marirangwe, dairying was the most important source of income

for the interviewed households whilst it was the second most important source of income in Chikwaka.

Table 4. 3Ranking indices and ranks

Source of income	Marirangwe		Chikwaka	
	Weighted rank	Ranking index	Weighted rank	Ranking index
Dairy	101	0.306	92	0.256
Horticulture	40	0.121	103	0.287
Formal employment	27	0.081	5	0.014
Informal sector	32	0.097	75	0.209
Pension	33	0.100	17	0.047
Tobacco	38	0.115	0	0.000
Other	59	0.179	67	0.187

NB: Source of income with the highest ranking index were the most important

4.1 Comparison of mean costs

Veterinary costs, transport costs, labour costs, feed costs, breeding costs and gross margins for Marirangwe and Chikwaka were compared using t-test for independent samples. There were significant differences ($P<0.05$) in gross margins ($t=-2.64$; $P=0.0112$), feed cost ($t=2.11$; $P=0.046$), Breeding costs ($t=2.30$; $P=0.0252$) and total variable cost ($t=2.02$; 0.0495) between Marirangwe and Chikwaka dairy farmers. However, there were no significant differences ($P>0.05$) in veterinary costs, labour costs and transport costs between Marirangwe and Chikwaka dairy farmers.

Table 4. 4Comparison of the mean component costs

Cost component	Mean values	
	Marirangwe	Chikwaka
Feed cost ($)	2 217.70[a]	9 490.60[b]
Veterinary cost ($)	152.30[c]	136.70[c]
Transport cost ($)	101.50[d]	51.19[d]
Labour cost ($)	530.80[e]	33.50[e]
Breeding cost ($)	9.65[f]	25.72[g]
Total variable cost ($)	3 011.90[h]	10 041.70[k]

NB: means with different superscripts within row are significantly different (P<0.05)

4.2 Gross margin analysis

Table 4.5 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.

The results ultimately show that small-scale dairy farmers in Marirangwe and Chikwaka are not economically viable. Mean annual gross margins were negative in both areas with -US$219.50 and -US$551.43 in Marirangwe and Chikwaka respectively. The mean daily milk production per cow per day for dairy crosses was four litres in Marirangwe versus two litres in Chikwaka with a mean negative return per litre of -US$0.04 and -US$0.48 respectively.

Table 4. 5Gross margin analysis for Marirangwe SCC and Chikwaka communal for the period April 2013-May 2014

	Marirangwe	Chikwaka
1. Mean Dairy Income	Mean Total (US$)	Mean Total (US$)
Mean value of milk sold to the milk collection centre and sold locally	2,792.42	568.44
Mean Total gross income for dairy enterprise	2,792.42	568.44
2. Mean Variable Costs		
Mean total costs for purchased feeds (stock feed) + Mean total costs for home-grown feeds (forage-seed, fertilizer, hay/ silage)	2217.69	568.76
Mean total veterinary costs (drugs + vaccines)	152.27	136.70
Mean breeding cost (AI/Bull hire)	9.65	25.72
Mean total costs for hired labour + Family Labour	530.77	337.50
Mean total transport costs	101.54	51.19
Mean Total Variable Costs	3011.92	1119.87
3. Mean Gross Margins		
Mean Gross Margin (US$)	-219.50	-551.43
Mean Gross Margin per Cow (US$)	-54.88	-275.72
Mean Gross Margin per Total Variable Costs (US$)	-0.07	-0.49
Mean Gross Margin per Feed Costs ($)	-2.28	-3.37
Mean Gross Margin per litre ($)	-0.04	-0.48

4.2.1 Comparison of gross margins

The gross margins for farmers in Marirangwe and Chikwaka were compared using the t-test for independent samples. Farmers in Marirangwe had significantly higher (t=-2.68; P=0.0103) gross margins than those in Chikwaka although both had negative gross margin values on average (Table 4.5).

4.3 Capital Efficiency

The capital efficiency of small-scale dairy enterprises is shown in Table 4.6. The mean investment per cow and mean asset turnover ratio were compared using t-test for independent samples. There were significant differences (P<0.05) in mean investment per dairy cow (t=-3.05; P=0.0052) and mean asset turnover (t=-2.08; P=0.0469). In Marirangwe, the mean investment per dairy cow was higher than Chikwaka and hence the efficient use of money. Marirangwe also had a higher asset turnover ratio than Chikwaka hence its assets generated more revenue.

Table 4.6: Capital efficiency of Marirangwe and Chikwaka

Area	Mean investment per cow ($)	Mean asset turnover ratio ($)
Chikwaka	1110.40[b]	0.0491[d]
Marirangwe	1506.50[a]	0.1808[c]

NB: means with different superscripts within row are significantly different (P<0.05)

4.4 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.

4.4.1 Marirangwe

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 ($P>0.05$). Figure 4.1 shows the regression diagram for Marirangwe as represented by the regression equation:

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

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.

Figures 4.1 and 4.2 show the regression graphs for transport and veterinary cost on gross income for Marirangwe. 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.

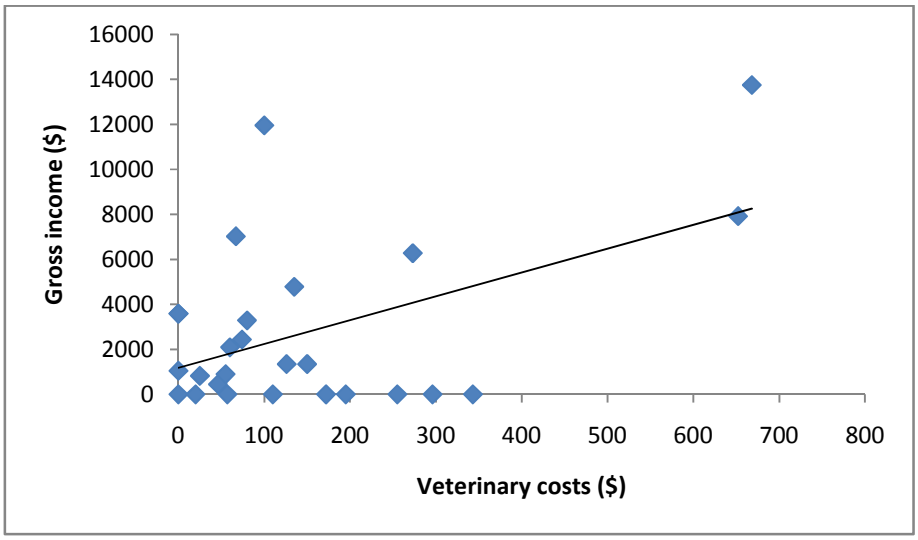


Figure 4. 1Regression of veterinary costs on gross income (yijk=826.39 + 5.978x1 + eijk) for Marirangwe small-scale dairy farmers

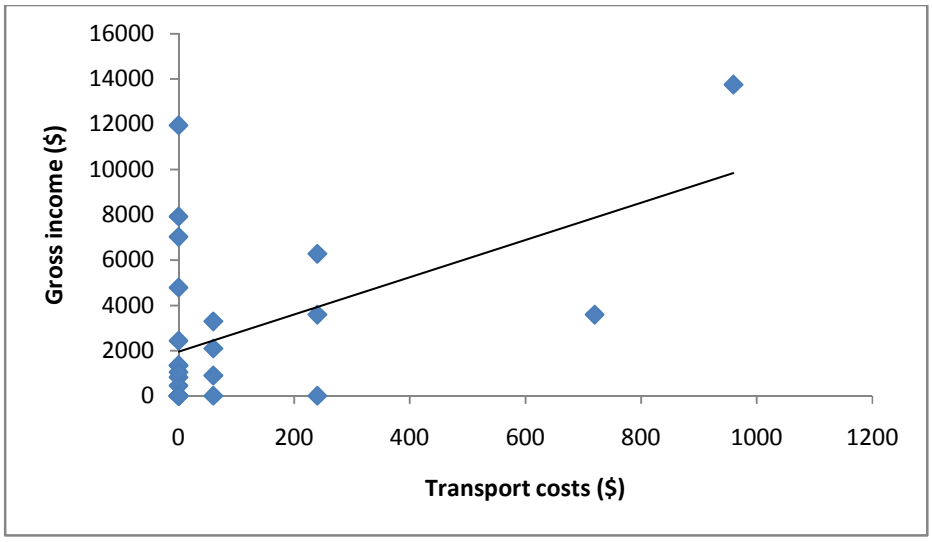


Figure 4. 2Regression of transport costs on gross income (yijk=826.39 + 6.478x2 + eijk) for Marirangwe small-scale dairy farmers

4.4.2 Chikwaka

Gross income for dairy farmers in Chikwaka were significantly ($P<0.05$) influenced by feed costs ($\beta=0.0243$). All the other costs related to labour, breeding, transport and feeding did not significantly influence gross incomes ($P>0.05$). Figure 4.3 shows the regression diagram for Chikwaka as represented by the regression equation:

$$y_{ijk}=286.00 + 0.02438x_1 + e_{ijk}$$

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

x_1 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.

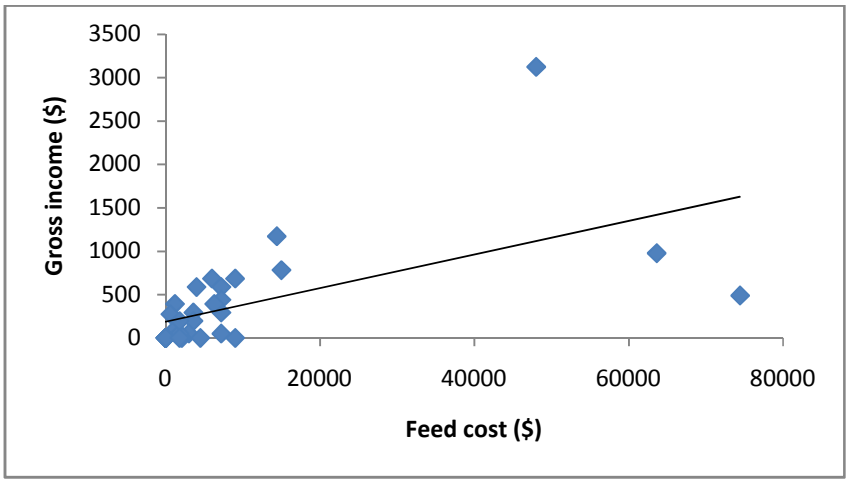


Figure 4.3 Regression of feed cost on gross income ($y_{ijk}=826.39 + 6.478x_2 + e_{ijk}$) for Chikwaka small-scale dairy farmers

4.8 Correlations between gross income and cost components

Table 4.7 shows the correlations between the gross income and the cost components for Marirangwe and Chikwakasmall-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 4. 7Correlation (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)

4.5 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.

4.9.1 Chikwaka

Gross income was significantly ($P<0.05$) influenced by the number of lactating cows ($\beta=375.62$) within the herd as well as the amount of feed consumed ($\beta=0.28$) 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.

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

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

x_1 are the number of lactating cows;

$x_2$represent the feed consumption.

E_{ijk} are the random residuals.

Figures 4.3 and 4.4 show the regression graphs for number of lactating cows and feed consumed on gross income for Chikwaka.

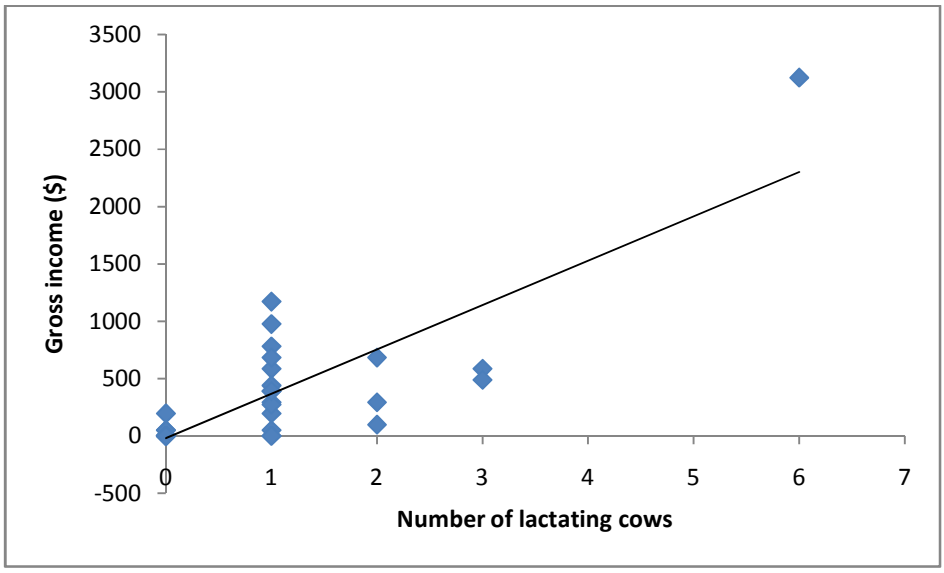


Figure 4. 3Regression of number of lactating cows on gross income for Chikwaka small-scale dairy farmers

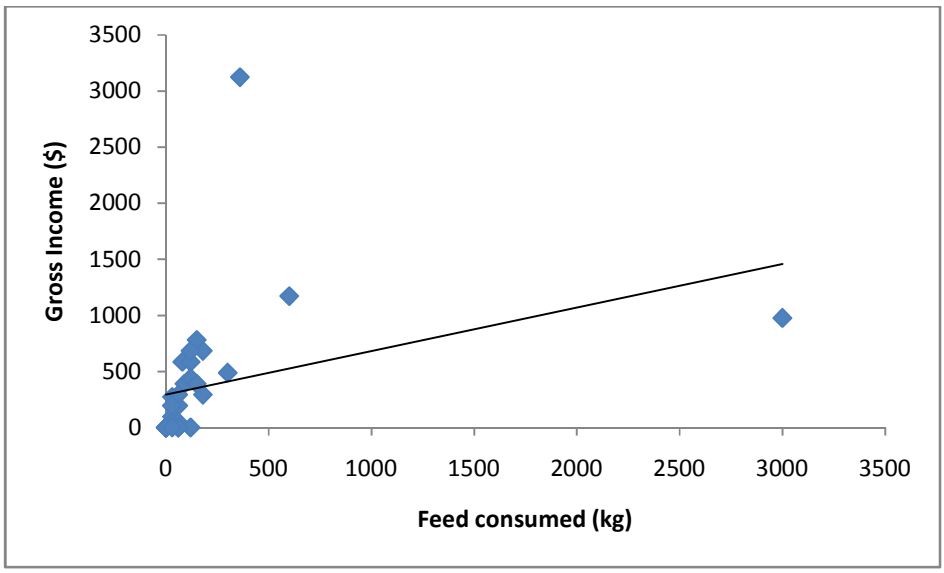


Figure 4. 4Regression of amount of feed consumed on gross income for Chikwaka small-scale dairy farmers

4.9.2 Marirangwe

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.

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

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

x_1 are the number of lactating cows;

e_{ijk} are the random residuals.

Figure 4.5 shows the regression graphs for number of lactating cows on gross income for Marirangwe.

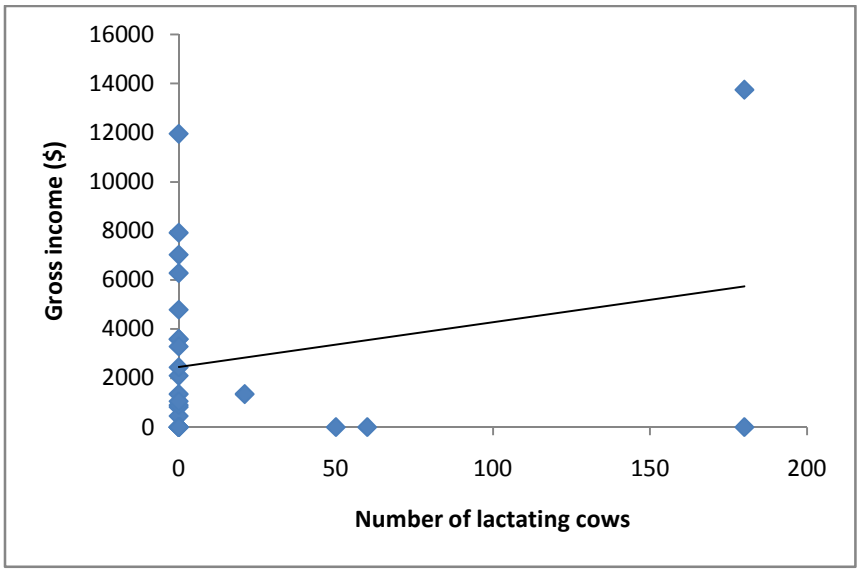


Figure 4. 5: Regression ($y_{ijk} = -658.36 + 761.37x_1 + e_{ijk}$) of number of lactating cows on gross income for Marirangwe small-scale dairy farmers

4.6 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 percentwere supplying raw fresh milk and 30 percent are supplying sour milk (Amasi). The farmers who wereengaged 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.

Figure 4.6 shows the challenges faced by the farmers in marketing their milk for both Marirangwe and Chikwaka.

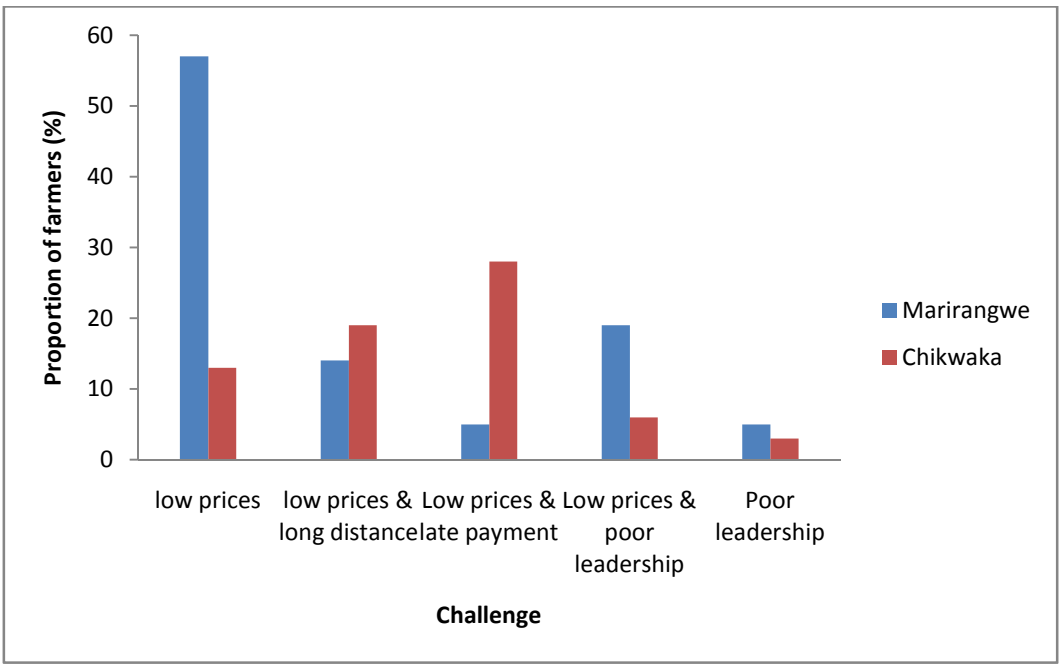


Figure 4. 6Challenges faced by farmers in marketing milk

Figure 4.7 shows the most common modes of transport used by the farmers to transport milk to the milk collection centre. The most common mode of milk transportation usedby the farmers in Marirangwe and Chikwaka was bicycle transportation with 55 percent, and 53 percent respectively.

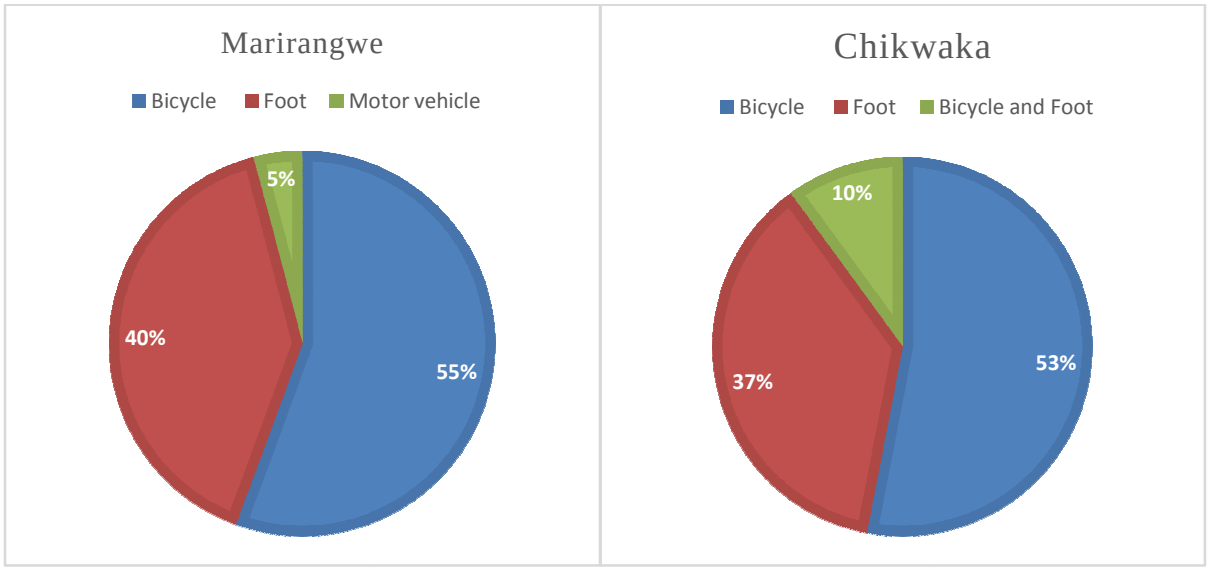


Figure 4. 7 : Mode of transport for Marirangwe and Chikwaka

Distance is another key factor that affected the marketing of milk products by the small-scale farmers. In Marirangwe 24 percent of the farmers lived less than one kilometre from the MCC, 38 percent between one and five kilometres and 38 percent between five and ten kilometres. In Chikwaka, 74 percent lived between one and five kilometres from the MCC, 20 percent between five and ten kilometres and six percent between ten and twenty kilometres.

An interview with a key informant revealed that although low milk volumes against high operational costs was the key determinant affecting the marketing of small-scale milk, the MCCs were also being mismanaged. Hence the selection of management committees was not done based on the ability of the foresaid to manage the operations of an MCC but it was based on ones' social status. The most popular got the positions of chairmanship, treasurer and secretary. The selected had no capacity to handle the financial management of the MCCs and hence poor decision making was rampant.

4.7 Chapter summary

This chapter presented the results of the study. A 92 percent response rate was achieved in the study. Demographic information was summarised representing house hold size, gender, marital status, occupation, educational background and experience of the house hold head. Ranking indices of sources of income showed that in Marirangwe dairy was number one. However, in Chikwaka it was number two. A gross margin analysis showed that dairying in Chikwaka was not viable. However, in Marirangwe gross income was influenced by transport and veterinary costs and in Chikwaka gross income was influenced by feed costs. The review non-monetary factors influencing gross income showed that the number of lactating cows and feed consumed influenced gross income in Chikwaka and only the number of lactating cows influenced gross income in Marirangwe. Capital efficiency ratios showed overall inefficient use of capital resources in Marirangwe and Chikwaka.

CHAPTER 5

5 DISCUSSION, CONCLUSION, RECOMMENDATIONS

1.0 Introduction

The chapter discusses key findings in the study of the economic viability of small-scale dairy farmers in Marirangwe and Chikwaka. Conclusions are therefore drawn from the findings and recommendations given on strategies to upscale the potential of small-scale dairy farmers in Zimbabwe.

1.1 Discussion of key findings

The average household size was 5.2 and 5.5 for Marirangwe and Chikwaka respectively. Overall mean household size was 5.3. Osotimehin et al (2006) state that the size of the household is indicative of availability of labour on the farm. Staal et al (1998) complements Osotimehin's views by stipulating that a larger household is representative of increased labour in the household. In Marirangwe, farmers situated in the small-scale area had a 49 percent response rate for use of family labour, 22 percent for use of casual labour and 29 percent for the use of both family and casual labour. In Chikwaka 84 percent of the respondents used family labour and 16 percent used both family and casual labour. The mean number of household members active in dairying were two in Marirangwe and three in Chikwaka.

The level of agricultural training of the household head was also determined. In Marirangwe 45 percent of the household heads received basic agricultural training, 26 percent received Master Farmer training, 24 percent received Advanced Master Farmer training, and five percent held a diploma. In Chikwaka, 53 percent of the farmers

received basic agricultural training, 41 percent Master Farmer training and six percent Advanced Master Farmer training.The results imply that Marirangwe farmers are better able to apply and adopt the training received more than Chikwaka farmers. In Marirangwe 73 percent of total variable costs was spent on feed whilst in Chikwakait was 51 percent. The exposure of dairy cows to free range grazing practices has negative impacts on output of milk received. However, this was the case in Chikwaka were 73 percent of the farmers exposed their animals to free range grazing.

The overall mean number of years of experience of the head of household was 7.8. The mean for Marirangwe was 10.5 and Chikwakafive years. It is evident from the data that the average number of years of dairying of Marirangwe was significantly different from that of Chikwaka farmers ($P<0.01$). The results therefore imply that Marirangwe farmers are more experienced than Chikwaka farmers and therefore have a higher likelihood of adopting improved technologies. Makokha et al (2007) seem to concur with this statement as they ascertain that households with experience in dairying have been able to feed their animals, diagnose and control diseases.

The use of gross margins was useful as it gave an indication of the level of economic viability of small-scale dairy farmers. Similar studies by Hanyani-Mlambo (2000); Zvinorova (2010); Tegemes Institute of Agricultural Policy and Development (2011); Nyekanyeka (2011) and (Mumba, 2012) used gross margin analysis to establish the viability of small-scale dairy enterprises. However these researchers where limited to profitability ratios, whereas they could have also analyzed capital efficiency ratios to ascertain the measures of the capital invested by the business (Shoemaker et al, 2008). The study went on to calculate capital efficiency ratios such as dairy investment per cow

which allows one to measure the efficiency of the money invested in the dairy farm and the asset turnover ratio which measures the efficiency by which all farm assets generate revenue (Shoemaker et al, 2008).

The economic evaluation of small-scale dairying from this study indicated that it was not viable. Similar results were obtained in earlier studies in Zimbabwe by Zvinorova, 2010 and Hanyani-Mlambo (2000). This was attributed to mainly poor management as this study also indicated that farmers did not dip, dose or vaccinate their animals regularly. Feeding was not standard and investment in dairying low.

Hanyani-Mlambo (2000) indicated that a gross margin analysis at farm level established that small-scale dairying in Zimbabwe is hardly viable. He identified constraints to production, labour bottlenecks, inadequate feeding bases, poor breeding practices and production inefficiencies. Problems arising from limited markets, narrow product bases, recurrent droughts and stringent economic reforms were said to have had devastating effects on viability of the small-scale dairy sector.

The study by Zvinorova (2010) concluded small-scale dairying in Wedza which is also in Mashonaland-East province was not viable. Poor management mainly attributed to losses incurred by farmers. The economic viability and growth potential of small-scale dairy farming in Wedza was a measure efficiency and proximity to markets.Her study also postulated that the scope for increasing profitability and productivity was as a result of an increase in herd size and improved efficiency.

In the study a number of explanations why these small-scale dairy enterprises in Marirangwe and Chikwaka were not viable are possible. Firstly, in Marirangwe total feed costs constituted 73percent of total variable costs and 79 percent of gross income. The investment in dairy concentrates was significantly high, comprising 85percent 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. However in Chikwaka it is evident that investment in feed costs was low with feed costs constituting 51 percent of total variable costs. About 75 percent of the farmers relied on free range feeding regimes and 15 percent used a combination of free range and other 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.

Secondly, investment in reproductive costs was also significantly low as the breed of the animal used determines the output. 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.

Thirdly, the health of the dairy cow also determines its output. In Marirangwe all the farmers identified black leg diseases as a major health constraint whilst 90 percentof the farmers had problems with tick borne diseases and internal parasites. However only 20 percent of the farmers vaccinated their animals against blackleg. Mastitis is a condition that affects the quality of the milk and hence results in milk rejections at the milk collection centre and affects the end price quoted by a larger process. On the whole it affects the gross income of the farmer. In Marirangwe 65 percent of the farmers were affected by this disease. In Chikwakaall the farmers identified black leg diseases, and 80 percent tick borne diseases and internal parasites as diseases affecting their animals the most. However only 30 percent of the farmers indicated that they vaccinated their animals against blackleg. An interview with the Chairperson of ChikwakaMPA also revealed that the quality of milk sold to the MCC by Chikwaka farmers was heavily compromised by high bacterial and somatic cell counts. High bacterial counts were as a result of poor hygienic practices and high somatic cell counts as a result of mastitis.

Chikwaka MCC sells 50 percent of its product as cultured milk to the local market. Although the price per litre for cultured milk was pegged at US$1.00 per litre, the average mean return per every litre produced in the past twelve months was $0.05 cents. This was as a result of a poor quality product penetrating the market. The shelf life of the product was 60 percent of the expected timeframe. This was as a result of high bacterial counts in milk delivered to the MCC. The markets for cultured milk have shrunk over the years as a result of consumer tastes and preferences changing and preferring substitute products as a result of higher incomes. The MCC resorted to

travelling further away from the local proximities in search of markets. Transportation costs also increased as a result.

Capital efficiency is the return on the capital expended on the dairy farm (Shoe-maker et al, 2008). In Marirangwe, the mean dairy investment per dairy cow was higher than Chikwaka. However both Marirangwe (US$1,506) and Chikwaka (US$1,110) were below the recommended mark of US$7,000 (Shoe-maker et al, 2008). This implied that small-scale dairy farmers were failing to efficiently use the money that they had invested on their farms for example the land and infrastructure.The mean asset turnover ratios (ATR) for Marirangwe (0.18) and Chikwaka (0.05) were below the recommended mark (≥0.60) (Shoe-maker et al, 2008). The low ATRs implied that the small-scale dairy farmers in Marirangwe and Chikwaka were failing to efficiently utilize their farm assets to generate revenue.

Although the small-scale farmers in Kenya were said to be viable in a study conducted by the Tegemes Institute of Agricultural Policy and Development (2011), consequently the gross margin to variable expenses was significantly lower for all households regardless of the grazing systems used. This was indicative of the fact that every dollar invested in total variable costs gave a return of just a few cents. The cost of feed was said to be the greatest constaint. In the study feed costs comprised 73 percent and 51 percent of total variable costs in Marirangwe and Chikwaka. However, gross income($P<0.05$) was influenced by feed costs ($\beta=0.0243$) in Chikwaka. 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 ($P>0.05$). This implied that if the farmers improved

the health of their animals and invested in milk transportation their gross income would increase and hence economic viability.

The marketing of milk and milk products by small-scale dairy farmers in Marirangwe and Chikwaka was influenced by a number of factors. In Marirangwe the average price per litre was pegged at US$0.48. The farmer was not a price determinant and therefore 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 is purchased by DZPL, and in the past twelve months according to the records of the MCC, their quoted price per litre has ranged between US$0.42-US$0.45. 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 Marirangwe and Chikwaka.

As a result of low pricing farmers naturally shy away from the MCC as a market and start side selling their milk. It was difficult to establish the exact volume of milk being channeled to the informal market (side market) as it is in breach of their constitutional agreement as members of the MCC. In the Chikwaka and Marirangwe constitutions, it is unconstitutional for a member farmer not to sell their milk to the MCC. If discovered, one is subject to suspension from the milk producer association and depending on the severity and/or number of offences, ones' membership can also be cancelled. Hence all member farmers were mandated to deliver all their milk to the bulking centre. However, the farmers indicated that within their locality they were able to sell the raw fresh milk between US$0.80 and US$1.00 per litre and US$1.00 for a 300 milliliters of sour milk.

However, their main market for raw fresh milk was the MCC as the market for both raw and sour milk within the locality was limited.

The distance from the MCC clearly has a bearing on the marketing of milk and milk products. In Marirangwe the majority of the farmers (62 percent) lived within a 10 kilometre radius from the MCC and 95 percent of the farmers used foot and bicycle transportation methods to deliver their milk to the MCC. However in Chikwaka, 94 percent of the farmers lived within the 10 kilometre radius from the MCC and all used foot and bicycle transportation methods

1.2 Conclusions

The study established that small-scale dairy farmers in Marirangwe and Chikwaka are not economically viable. This was shown by negative gross margins for both areas. Capital efficiency ratios for Marirangwe and Chikwaka also showed lowdairy investment per cow and asset utilization ratio.

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 Marirangwe and Chikwaka.

A number of factors affected the marketing of milk and milk products. These included low pricing, late payment, poor leadership and long distance to the market.

1.3 Recommendations

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. In Chikwaka, the availability of land has been a challenge and hence farmers invest less in pastures as they compete with staple foods. We would recommend, that development partners address this shortcoming by embracing private sector development and identifying players along the value chain willing to invest in commercialization of fodder production. Hence, if farmers have access to fodder supplies, output per cow is expected to increase and ultimately income.

Farmers have a challenge of access to credit facilities as they may not have immediate finances and collateral. Fodder suppliers could liase with MCCs to deduct monthly from farmer milk cheques and remit to the supplier and therefore that becomes some form of credit facility.

The number of lactating cows has 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. At a policy level, there is need to invest in breeding centres to provide small-scale dairy farmers with affordable dairy crosses and breeds that can tolerateadverse climatic conditions.

The greatest challenge to farmers has been access to suitable financial products to invest in their enterprises. There is need to introduce tailor-made financial products suitable for small-scale dairy farmers. In the past twelve months 81 percent of the

farmers in Marirangwe have been able to access credit facilities and 19 percent have not been able to access credit facilities to finance their dairy enterprise. The percentage of farmers by type of loan in Marirangwe 43 percent of the small-scale dairy farmers accessed the heifer loan scheme, five percent cash, five percent feed, five percent drugs, five percent heifer and drugs and 37 percent heifer, feed and drugs. In Marirangwe 57percent received their loan from the MPA through donor funded aid, 38 percent was received from Kefalos (a large processor in the area) and five percent bank and milk producer association. However in Chikwaka 79 percent of the farmers were able to access credit facilities and 21 percent were unable to access credit. Of the respondents who accessed credit, 94 percent of the farmers received a credit facility from the MPA through donor funded aid and 6 percent directly from the bank. Heifer loan schemes were accessed by 48 percent of the farmers, drugs 36 percent and cash 16 percent.A greater proportion of the credit received by the small-scale farmers was from the MPA's through donor funded interventions for example the 'Heifer Revolving Fund' through ZADF/EU Stabex and 'Cattle Bank Facility' (CBF). However the farmers were limited to only one n-calf heifer whereas the findings in the study relate the number of dairy cows to gross income. Hence the more lactating dairy cows one has the more revenue they are likely to receive. At policy level, the government should invite players in the financial services industry to invest in this sector opening up lines of credit to access good dairy breeds, feed and veterinary services.

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 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.

The governance of MPAs should be reviewed as well. Farmers are the owners of the MPA and hence elect the management committee to run the business. However, this does not divorce the farmers from influencing the running of the MCCs and playing advisory roles. The challenges faced by the MCC of low milk volumes and poor quality milk that have a bearing on the pricing are the responsibility of the farmer. Farmers should therefore be involved in strategic planning processes and hence he held accountable at the apex level (MPA). If planning is done well, farmers should be able to know what volumes they require to breakeven and the expected level of investment for their business to be economically viable. The strategic plan of the MPA therefore cascades down to farm level as the apex relies on the efficiency of the former for it to be viable. The management committee and staff should be accountable to the farmers on a monthly basis as they account for costs incurred and revenue received and ultimately the pricing of the product.

The quality of the milk and volumes produced have also had a bearing on the pricing and income received. The MCCs could attract higher volumes and better quality by possibly introducing quality and volume based incentives or premiums on pricing. When the farmer is aware that if he delivers poor quality milk, his price is affected then quality

becomes a priority. 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 investment in transportation subsidies and back-up generator loans by DZPL has assisted in improving milk quality.

Although organisations such as Land O' Lakes, We Effect and ZADF have invested heavily in small-scale dairy farming in Zimbabwe, the time frame of projects implemented has been short. Short time frames have posed as a constraint, because by the time the project ends after two years the time period has not been adequate to realize impact. As a result of low literacy levels amongst small-scale dairy farmers in Zimbabwe the adoption of new technologies and practices takes slightly longer, hence the need for five to ten year funded projects to allow for teaching, mentoring and full adoption. Although the government has partnered with these 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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APPENDIX A: QUESTIONNAIRE FOR SMALL-SCALE DAIRY FARMERS

Date:		Name of Enumerator:
Province:	District:	Name of Milk Producer Association:
Deliveringto MCC?		

A. DEMOGRAPHICS			
1. Classification by Type of Settlement:	1=Small-Scale Commercial	2=Old (Phase 1) Resettlement	
2. Classification by Management System	1=Zero grazing	2=Paddock system	3=Free/open range
3. Classification by feeding methods	1=natural pasture	2=forage	3=silage/hay
4. Classification by Dairy Breeds	1=Pure breeds	2=Crosses	3=Indigenous

B. SOCIO-ECONOMIC CHARACTERISTICS			
5. Household Size:	6. Number of HH members active (providing labour) in dairying:		
7. Sex of Household Head			
8. Marital Status of Household Head	1=Married	2=Single	3=Widowed
9. Highest Level of Education of H/Head	1=Primary	2= ZJC/Std. 6	3= Secondary
10. Occupation of H/Head	1=No formal employment		2= Employed
11. Agricultural Training of H/Head	1=MF	2= AMF	3= Diploma
12. Experience (number of years in smallholder dairying):			

C. INCOME SOURCES

13. Rank the sources (1-5)

Income Source	Rank
Dairy	
Horticulture	
Formal Employment	
Informal Sector	
Pension	
Tobacco	
Other (specify)	

D. PRODUCTIVE PERFORMANCE

14. Type of cattle 1. Heifer 2. Bull 3. Bull calf 4. Heifer calf 5. Cows	15. No.	16. Type of Breed 1. Indigenous 2. Friesian 3. Holstein 4. Jersey 5. Red Dane 6. Crosses (See index)	17. No. of lactating animals	18. Source 1. Local purchase 2. Inherited 3. MCC Cattle Bank Facility 4. Heifer Pass-on	19. Lactating stage 1. Early 2. Middle 3. Late 4. Dry 5. Late pregnancy	20. Offtake	
						Consumed	Sold to MCC other
1.							
2.							
3.							

Index Crosses: A= M/RD-Mashona/Red Dane B=M/J-Mashona/Jersey C=M/H-Mashona/Holstein-Friesland D=M/F-Mashona/Friesland E=J/RD-Jersey/Red Dane

E. INCREASE IN LIVESTOCK

21. Increase In Number Of Livestock And Value In The Past 12 Months

Type	Number of stock at the start of the year	Value of stock at the start of the year (USD)	Number of stock sold during the course of the year	Number of stock purchased during the course of the year	Number of stock at the end of the year	Value of stock at the end of the year (USD)
Cows						
Bulls						
Bull calves						
Heifers						
Heifer calves						
Total						

22. How many times per day do you milk your cow(s) ☐

1=Once 2=Twice 3=Three times

23. Lactation period (period of milking) …… months

24. Average dry period for your cows…….. months

F. FEEDING

25. What feeding regime do you use? ☐

1=Zero grazing 2=Free range 4=Other (specify) _____

26. Type of supplementary feed (Tick where applicable)	27.No of times fed/day 1. Once 2. Twice 3. More than three times	28.. Quantity fed to lactating cow at a time	29. Cost of feed		30. How much is consumed in a month by one cow
			Unit of measure	Price	
1. Dairy concentrates					
2. Maize bran					
3. Commercial molasses					
4. Cotton seed cake					
5. Sunflower seed cake					
6. Soy seed cake					
7. Other (Please specify)					

31. What are the problems with supplement feeding? ☐

1=Cost of supplementary feeds 2=Availability 3=Inconsistent supply

32. What is the source of forage on your farm?

1=Own production 2=Buying 3=Free grazing from communal

4=Other (specify) _____

33. If own production what type of forages do you grow?

1=Napier 2=Rhodes 3=Lab lab 4=Lucina 5=Other (specify) _____

34. How much land has been allocated for pasture? _____

35. Are you buying fodder? If yes how much per unit? _____

36. Are you facing challenges with feeding your cows fodder?

1=Yes 2=No

37. What are the major challenges with feeding your cows fodder?

1=Inadequate land 2=Labour availability 3=Access to seeds 4=Erratic rainfall

5=Other (specify) _____

G. ANIMAL HEALTH

38. How often do you deworm your milking cows?

1=Once per year 2=Twice per year 3=Thrice per year 4=Others (specify)

39. What do you use to deworm_____

40. Quantities used to deworm_____

41. Amount spent on deworming per year _____

42. How often do you vaccinate your animals?_____

43. What vaccines do you use?_____

44. Types of vaccines used?_____

45. How much do you spend on vaccinations per animal?_____

46. Please identify the most common diseases in your herd

Disease	1. Yes 2. No	Method of control
Tick-borne disease		
Mastitis		
Black leg		
Anthrax		
Internal parasites		
Other(s)		

47. What measures do you use to prevent diseases?

_____

48. How frequently did you treat your animals (past 12months)?_____

49. Who provides animal health services in your area?_____

50. What is the cost of hiring for veterinary services received?_____

51. How often do you dip/spray your animals

(a) Dry season (b) Wet season

52. How much do you spend on dipping animals per year?_____

Other expenses

53. How much money do you spend on the following per month?

(a) Detergent paste (soap), teat dip medicine, cups and milking cream_____

(b) Medication (mastitis and other diseases) per year_____

H. REPRODUCTIVE PERFORMANCE

54. (a) What method are you using in breeding your animals? ☐

1. AI 2. Bulls 3. Both methods

55. (b) Why are you using those methods?_____

56. If you are using AI what is the cost incurred per insemination (please give break down where applicable)? _____

57. Who has been providing the AI service in your area? _____

58. If using a bull what is the cost? _____

59. How many animals did you inseminate? _____

60. How many animals conceived? _____

61. What were your total AI costs in the past 12 months? _____

62. What were your total bull costs in the past 12 months? _____

63. What is the calving rate in your herd? _____

64. Have you been facing any breeding challenges? _____

I. LABOUR

65. What source of labour is used for dairy activities? ☐

1=Family members 2=Casual labour 3=Both 4=Other (specify)_____

66. If casual labour how much is the cost per month? _____

67. Hours dedicated towards dairying per day_____

J. TRANSPORTATION

68. Mode of transportation for milk deliveries

1=On foot 2=Bicycle 3=Ox cart 4=Donkey 5=Motor vehicle6=Others (specify)_____

69. How far is your place to the MCC?

1=Less than 1km 2=1-5 km 3=5-10 km 4=10-20 km 5=Over 20km

70. What is the monthly cost of transporting milk to MCC? _____

71. What type of container is used to transport milk to MCC?

1=Plastic bucket 2=Stainless steel 3=Other (specify) _____

K. MILK MARKETING

72. Where do you sell your milk?

1= MCC 2=middle men 3=within the village

73. What prices do you receive (per litre) from the following

Buyer	**Fresh/Sour milk**	**Price quoted per litre**
MCC		
Middlemen		
Within the village		

74. Do you sell more fresh milk or sour milk? _____

75. If delivering to an MCC how far are you from the MCC? ☐

1= <1km 2=1-4.9 km 3=5-9.9 km 4=10-14.9 km 5=15-19.9km 6=> 20km

76. If you are not delivering milk to the MCC what is your reason?

_____

77. What challenges are you facing with the marketing of milk? ☐

1=Low milk prices 2=Long distance 3=Late payments 4=Poor leadership of the MCC 5=Other (specify) _____

78. Identify an activity that attracts the most costs on your dairy farm ☐

1=Feed 2=Veterinary 3=Marketing costs 4=Labour

5=Other (specify) _____

L. EXTENSION SERVICES

79. Do you have access to extension services? ☐

1=Yes 2=No

80. Who provides dairy extension services in your area?

1=Government 2=NGO (specify) _____ 3=both ☐

81. What training and extension support have you received in the last 12 months?

_____

M. ACCCESS TO CREDIT FACILITIES

82. Have you received any credit facilities to finance your dairy enterprise in the last 12 months?

1=Yes 2=No ☐

83. If yes, what type of loan did you receive? ☐

1=Heifer loan scheme 2=Cash loan 3=Feed loan 4=Drugs 4=Semen

4. Other (specify) _____

84. What was the source of the loan you received ? ☐

1=Bank/ Microfinance institution (specify) _____ 2=MCC

3= Large processor (specify)_____

4=Other (specify) _____

85. Has the loan been repaid in full?

1=Yes 2=No ☐

86. If no, state the reason(s)

_____

_____

N. ASSETS

87. What is the value of the following assets?

Asset	Unit price	Number	Value (US$)
Milking parlour			
Water trough			
Feed trough			
Race			
Fenced kraal			
Calf pen			
Hay shed			
Silage pit			
Land			

O. GROSS MARGIN ANALYSIS			
1. Dairy Income (April 2013 – May 2014). ***** Take into consideration the seasonal (month by month) changes in milk output and unit prices.*			
	Quantities Sold (litres)	Unit Price (US$/litre)	Total Income (US$)
Value of milk sold to the milk collection centre			
Value of milk sold locally			
Gross income from dairy livestock sales			
Total dividends received			
Total Gross Income for dairy enterprise			
2. Variable Costs (April 2013 – May 2014) ***** Take into consideration the seasonal (month by month) changes in milk output and unit prices.*			
Total costs for purchased feeds (stock feed)			
Total costs for home-grown feeds (forage-seed, fertilizer, hay/ silage)			
Total veterinary costs (drugs + vaccines)			
Breeding cost (AI/Bull hire)			
Total costs for hired labour			
Total costs for family labour			
Total transport costs			
Total Variable Costs (April 2013 – May 2013)			
3. Gross Margins			
Gross Margin (US$)			
Gross Margin per Cow (US$)			
Gross Margin per Total Variable Costs (US$)			
Gross Margin per Feed Costs ($)			
Gross Margin per Litre ($)			

APPENDIX B: INTERVIEW GUIDE FOR CHAIPERSONS OF MILK PRODUCER ASSOCIATIONS

1. What challenges are currently being faced by small-scale dairy farmers in the production and marketing of milk and milk products?
2. What challenges are currently being faced by the MCC as the key market for small-scale dairy farmer milk?
3. Who determines the milk price and why?

APPENDIX C: INTERVIEW GUIDE FOR GOVRNMENT EXTENSION FIELD STAFF

1. What challenges are currently being faced by small-scale dairy farmers in the production and marketing of milk and milk products?
2. What training curriculum do you offer to small-scale dairy farmers to enhance their proficiency?
3. What strategies can be put in place to upscale the viability statuesque of small-scale dairy farmers?
4. Do you currently complement your activities with NGOs that are supporting small-scale dairy farmers?
5. If yes, how do you ensure sustainability of extension services and/or new initiatives after the NGO project life cycle has come to an end?

APPENDIX C: INTERVIEW GUIDE FOR DAIRY INDUSTRY SPECIALIST AND ZADF OPERATIONS MANAGER

1. What challenges are currently being faced by small-scale dairy farmers in the production and marketing of milk and milk products?
2. What strategies can be put in place to upscale the viability statuesque of small-scale dairy farmers?

APPENDIX D: SAS OUTPUT

Marirangwe SAS System Regression Procedure

Dependent Variable: gross income

Number of Observations Read	26
Number of Observations Used	26

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr> F
Model	5	159206336	31841267	3.22	0.0270
Error	20	197643761	9882188		
Corrected Total	25	356850097			

Root MSE	3143.59477	R-Square	0.4461
Dependent Mean	2792.41577	Adj R-Sq	0.3077
CoeffVar	112.57617		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr> |t|
Intercept	1	826.39474	953.85719	0.87	0.3966
feedcost	1	-0.12575	0.09424	-1.33	0.1971
vetcost	1	5.97848	4.87511	1.23	0.2343

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr> |t|
reprocost	1	-5.48388	21.10489	-0.26	0.7976
labourcost	1	1.37488	1.53008	0.90	0.3796
transcost	1	6.47790	2.96224	2.19	0.0408

Marirangwe SAS Correlation procedure

2 Variables: grossincomevetcost

Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
grossincome	26	2792	3778	72603	0	13749
vetcost	26	152.26923	177.65169	3959	0	668.00000

Pearson Correlation Coefficients, N = 26 Prob> |r| under H0: Rho=0		
	grossincome	vetcost
grossincome	1.00000	0.49762 0.0097
vetcost	0.49762 0.0097	1.00000

2 Variables: grossincomefeedcost

Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
grossincome	26	2792	3778	72603	0	13749
Feedcost	26	2218	6830	57660	0	28800

Pearson Correlation Coefficients, N = 26 Prob> |r| under H0: Rho=0		
	grossincome	feedcost
grossincome	1.00000	-0.17024 0.4057

Pearson Correlation Coefficients, N = 26 Prob> |r| under H0: Rho=0		
	grossincome	feedcost
feedcost	-0.17024	1.00000
	0.4057	

Chikwaka SAS System Regression Procedure

Dependent Variable: grossincome

Number of Observations Read	32
Number of Observations Used	32

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr> F
Model	5	4662655	932531	3.80	0.0102
Error	26	6375986	245230		
Corrected Total	31	11038641			

Root MSE	495.20726	R-Square	0.4224
Dependent Mean	368.44000	Adj R-Sq	0.3113
CoeffVar	134.40649		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr> |t|
Intercept	1	286.00448	227.75744	1.26	0.2204
feedcost	1	0.02427	0.00645	3.76	0.0009
Vetcost	1	0.89036	1.12463	0.79	0.4357
reprocost	1	-6.12132	4.23240	-1.45	0.1600
labourcost	1	-0.11698	0.30566	-0.38	0.7050
transcost	1	-1.41963	0.97337	-1.46	0.1567

Chikwaka correlation procedure

2 Variables: grossincomefeedcost

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
grossincome	32	368.44000	596.72875	11790	0	3123
feedcost	32	9491	17932	303700	0	74400

Pearson Correlation Coefficients, N = 32
Prob> |r| under H0: Rho=0

	grossincome	feedcost
grossincome	1.00000	0.58170
		0.0005
feedcost	0.58170	1.00000
	0.0005	

The TTEST Procedure

Variable: investpercow

Area	N	Mean	Std Dev	Std Err	Minimum	Maximum
Chikwa	32	1110.4	91.3460	16.1478	1045.0	1535.0
Mari	26	1506.5	656.0	128.6	0	1867.5
Diff (1-2)		-396.1	443.5	117.1		

Area	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Chikwa		1110.4	1077.5	1143.3	91.3460	73.2324	121.4
Mari		1506.5	1241.5	1771.4	656.0	514.5	905.5
Diff (1-2)	Pooled	-396.1	-630.7	-161.5	443.5	374.5	544.1
Diff (1-2)	Satterthwaite	-396.1	-662.7	-129.5			

Method	Variances	DF	t Value	Pr> |t|
Pooled	Equal	56	-3.38	0.0013
Satterthwaite	Unequal	25.789	-3.05	0.0052

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr> F
Folded F	25	31	51.57	<.0001