

**CRITICAL ANALYSIS OF THE CONTRIBUTION OF SMALLHOLDER DAIRY FARMING TO  
THE LIVELIHOODS OF HOUSEHOLDS: THE CASE OF NHARIRA, ZIMBABWE**

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**March, 2017**

## DECLARATION

I, Hlekani Muchazotida Kabiti, hereby declare that this thesis for Doctor of Philosophy in Rural Development (PHDRDV) submitted to the Institute for Rural Development, School of Agriculture at the University of Venda has not been submitted previously for any degree at this or another university. It is original in design and in execution, and all reference material contained therein has been duly acknowledged.

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## ABSTRACT

As has been the case in Eastern and Southern Africa, Zimbabwe continues to regard smallholder dairy farming as a viable strategy for reducing poverty and malnutrition, especially in rural areas. Although the country has since the early 1980s been promoting smallholder dairy development, available literature does not provide a clear picture of the extent to which the specific livelihoods of rural communities in terms of human, social, physical and financial capitals, have improved. Nor is there knowledge on its negative contribution to the farmers' livelihoods. Thus, this study was undertaken to critically analyse the contribution of smallholder dairy farming towards the livelihoods of rural households using the Nharira dairy scheme as a focal area. The DfiD sustainable livelihood framework was used to build this understanding. Apart from characterizing the farmers, the contribution of smallholder dairy farming towards social, physical, human, natural and financial capitals was investigated.

A sequentially integrated mixed methods approach was used. This was divided into two phases, which were quantitative and qualitative in nature. Results from the first phase were used to inform and design the second study. A census of the 21 active smallholder dairy farmers in Nharira, and management committee of the Nharira dairy processing plant was conducted. A household-focused questionnaire, key informant interviews, participatory mapping, record review, Global Positioning System (GPS) locating and focus group discussions were used to collect data. A tape recorder, GPS locator and camera were used as assistive devices during data collection.

Thematic content analysis was used to analyse qualitative data and interpret participatory maps. Livelihood capital indices were derived per household and used to complement descriptive statistics as part of quantitative data analysis. A social capital index was computed for each household using collective action, empowerment, groups and networks, and trust and solidarity as its components. Resource stocks and access were the building blocks of the natural capital index. Income, savings and investments, and access to funding were used to derive the household financial capital index. Contribution of dairy farming to productive equipment (such as cattle herd size) and basic infrastructure (such as quality of housing) were used to calculate the physical capital index. The index for human capital was obtained taking into account education, workforce and employment, enabling environment, and health and wellness. Equal weights were applied to the components when deriving the household livelihood indices because each one of them was considered to be substantially important for sustainable livelihoods. The quantitative data were stored and analysed using the International Business Machines (IBM) Statistical

Package for Social Sciences (SPSS) version 24. Pearson correlation coefficients, means and standard deviations were calculated.

Most of the farmers (65 %) were female. Approximately, 95 % of the women farmers were literate. Only 1 % of the farmers were youth (< 35 years old), a situation that threatened the sustainability of smallholder dairy farming. A daily smallholder dairy farming routine was derived using the focus group and participatory mapping results. This showcased the various daily activities and linked them with the household members actively involved. Smallholder dairy farming was found to be labour intensive. This might deter the farmers from diversifying into other livelihood strategies. Smallholder dairy farming was observed to have strengthened financial, human, natural, physical and social capitals in the local households. However, the respective indices of 0.59 and 0.52 for social and natural capitals, suggested that smallholder dairy farming impacted on these more than any other. Even though social capital was strong, further reinforcement through improved smallholder dairy farming activities was still vital because of its power of enhancing access to other forms of livelihood capitals. Human and physical capitals had the least index scores of 0.48 and 0.47, respectively. On average, the overall household livelihood capital index as a result of smallholder dairy farming was 0.51. One of the study respondents supported the positive contribution in the following way, “*Zvakanakira dairy hatingazipedzi. Tinotoda zuva rese*” (There are many positive things that we attribute to our involvement in smallholder dairy farming. Narrating these demands considerable time). It was concluded that smallholder dairy farming significantly strengthened livelihood capitals of households involved in it.

The results of the current study suggest that smallholder dairy farming is a viable option for improving household livelihood capitals. Thus, establishment of dairy farming schemes in rural areas should be promoted. However, the participation of youth in smallholder dairy farming as enterprise owners deserves attention because it threatens sustainability of the sector. An integrated multiple angle view encompassing technical, social, institutional, economic and organizational ideas of the impact of dairy farming as a livelihood strategy on household capital portfolio was provided. Moreover, application of the sustainable development framework to understanding the smallholder dairy farming context at household level was a novel way of understanding the local realities. Lastly, a set of variables that can be utilised to measure livelihood capitals of households involved in smallholder dairy farming-related activities was distilled.

**Key words:** Critical analysis, contribution, household, livelihood, livelihood capital, smallholder dairy farming, Zimbabwe

*To my parents Joe Kabitani and Thulani Kabitani who had a vision of me reaching this academic level since my primary school days. The vision has finally manifested through their shepherding!*

## ACKNOWLEDGEMENTS

I would like to thank The Almighty God who saw me through to the end of writing this thesis. It is only by His Grace that I managed to put this thesis together despite all the hurdles I faced.

I am very grateful to my team of promoters, Professor J. Francis, Dr M. Manjoro and Dr O.S Obadire who made mammoth contributions to the framing of the thesis. I appreciate their guidance, mentorship and working beyond office hours in support of my work. The Institute for Rural Development family deserves special gratitude for its academic, emotional and resource support during my time as a PhD candidate. A special thank you goes to Ms Mphaphate for her continual all round support.

The University of Venda Research and Publication Committee (RPC) funded this study through a grant for the project (SARDF/12/1EC/0). In addition, the UNIVEN Research Ethics Committee approved the operationalisation of this project (SARDF/15/IRD/05/0610)

I feel greatly indebted to the Nharira Dairy Scheme farmers who participated in my study. A special thank you goes to Mr Ruzungunde and Mr Chiyangwa who went out of their way to ensure that I connected with the local farmers. Nharira Dairy Scheme staff members were greatly supportive and welcoming. Zigomo, T, Miranda, Machokoto, R and Kabiti, P offered immense research assistance and support during the data collection period. They went beyond just being enumerators to friends indeed during that research journey.

I am grateful to Kettering Foundation for providing me an international perspective and refuelling me up to finish off the thesis. A special thank you goes to Mudimeli R, Ndlovu C, Mkumbuzi S and Thabethe R for being always available to provide a second eye to my draft documents. My parents and sisters consistently encouraged me to take up the Ph.D. challenge and supported me all the way. The journey would not have been easier without their financial, emotional, moral and spiritual support. Thank you so much for being my undisputed pillars and cheer leaders.

Lastly, I am grateful to the Believers Loveworld Campus Ministries at UNIVEN for the spiritual support I enjoyed throughout my academic journey.

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## ABBREVIATIONS

AI	Artificial Insemination
DDP	Dairy Development Programme
DFID	Department for International Development
FAO	Food and Agriculture Organisation
FC	Financial Capital
GDP	Gross Domestic Product
GOZ	Government of Zimbabwe
HC	Human Capital
IBM	International Business Machines
IFPRI	International Food Policy Research Institute
IFAD	International Fund for Agricultural Development
NC	Natural Capital
NGO	Non-Governmental Organisation
PCA	Principal Component Analysis
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
SACCO	Savings and Credit Cooperative
SC	Social Capital
WEF	World Economic Forum
WFP	World Food Programme
ZDFA	Zimbabwe Dairy Farmers Associations
Zimstat	Zimbabwe National Statistics Agency

## CHAPTER 1: INTRODUCTION

### Preamble

In this chapter an introduction is given in order to set the scene for the study. The introduction is divided into various sections which, include background of the study, discussions on smallholder dairy farming systems and evolution of smallholder dairy farming in Zimbabwe. The above mentioned sections clarify the development and current status of smallholder dairy farming at international and local levels. The problem statement, objectives and hypothesis under study are given. Also included is the theoretical framework that guided the study and a list of operational definitions of key terms and words used in the study. The last part of the chapter is an outline of the thesis.

### 1.1 Background

It is reported (Food and Agriculture Organization: FAO, 2010) that throughout the world there are about 1.1 billion extremely poor people living in rural areas. Small-scale agriculture, in particular, determines their livelihoods. Smallholder farming is important for socio-economic development and improvement of the livelihoods of people living in rural areas (FAO, 2016; 2014). This is particularly true with respect to the role it plays in shaping the lives and livelihoods of those involved in it and the areas they reside in. The common changes in the livelihoods include increased household income, enhanced unity among the farmers as they share knowledge and tactics, and improvement in household nutrition (Nargunde, 2013). According to FAO (2008), smallholder livestock farming plays a significant role in improving household nutrition and also as a regular source of income. Thus, it is crucial to promote the growth and development of the sector.

The International Food Policy Research Institute (IFPRI, 2004) provides evidence in support of the importance of livestock ownership and dairy production in socio-economic, environmental and cultural values within African communities. Moreover, approximately 150 million farm households mainly in developing countries are engaged in milk production and marketing (FAO, 2010). Also worth noting is the Zvinorova *et al.* (2013), argument that because of difficulties relating to monitoring and quantifying the benefits derived from smallholder dairy farming economic analyses cannot fully explain the true picture. The latter authors further contend that there are more benefits derived from smallholder dairy production beyond profit. This is mainly due to the multiple products from the system, including providing milk, meat, income from milk sales, draught power for farm activities, social security, bearer of value which can be easily converted to cash and as an integral part of ceremonies (Mapekula *et al.*, 2009). Unlike other types of farming, smallholder

dairy farming is known for the nutritional benefits to the households involved. As such, dairy farming can play an important role in addressing the various livelihood needs of households if well implemented and managed.

## 1.2 Smallholder Dairy Farming Systems

Smallholder dairy farming systems are highly complex, risk-prone (mainly because of pests and diseases) and vary both in spatial and social terms (Tefera *et al.*, 2009). This situation presents an extra challenge to the smallholder farmers who are known to be prone to many other forms of risk and have limited adaptive capacity (Chimboza & Mutandwa, 2007). However, despite this challenge various smallholder dairy farming models exist in many parts of the world and are designed to counter the several impediments often encountered (FAO, 2009). Such models include cooperative dairy farming in India, contract farming in Sri Lanka, Dairy Park in China, dairy chain model in Mongolia and dairy zone in the Philippines (FAO, 2008). These have been applied in various parts of the world in accordance with the prevailing conditions and needs of the farmers. In general, the models endeavour to ensure that smallholder dairy farms remain viable and have access to markets, despite the various challenges they face.

Many countries in Africa, for example Ethiopia, Kenya, Uganda, Zambia and Zimbabwe promote smallholder dairy farming with the aim of alleviating poverty and improving the nutrition of the poor (FAO, 2004). As such the contribution and potential which lies within smallholder dairy towards livelihoods cannot be overlooked. However, the contribution needs to be unpacked so as to better understand the specific aspect of livelihoods that benefit the most.

Dairy farming is a major source of livelihoods in rural areas, particularly given the negative effects of climate change (Sirohi *et al.*, 2010). Climate change has brought with it increased incidences of drought which seriously threaten the sources of livelihoods of smallholder farmers who mainly rely on rain-fed agriculture. Dairy farming is a key managed alternative source of livelihoods. Because it is intensively managed, its high susceptibility to the impacts of drought can be controlled. Also, it provides an opportunity for diversifying the sources of income and other livelihood resources for smallholder farmers. Countries such as Uganda where smallholder dairy farmers own 90 % of the national milk producing herd, India (smallholder producers contribute about 65 % of the total national milk production), and Kenya (smallholder producers dominate the dairy sector and contribute 6 % of the country's gross domestic product: GDP); have made significant strides in smallholder dairy production (FAO, 2004; Meinderts & Omondi, 2009; Nargunde, 2013). All this evidence suggests that smallholder dairy farming has the potential to improve rural livelihoods by enhancing the various capitals which a household possesses.

People residing in the rural areas of Zimbabwe have land, which is the most important asset from which they derive their livelihoods through practising smallholder agricultural activities. Mapiye *et al.* (2006), argue that smallholder dairy farming taps into the opportunity to use idle fodder for meaningful socio-economic benefit. In the face of climate change, sustainability challenges continue to threaten smallholder agriculture. Through diversifying products, the farmers can adapt to the effects of climate change. By so doing, smallholder dairy farming should be viewed as an option which enables the farmers to strengthen livelihoods and improve household nutrition (Meinderts & Omondi, 2009). Taking this into account, several dairy development projects have been introduced in Zimbabwe since the 1980s (Munangi, 2007). To date, there are 30 smallholder dairy schemes in the country (Chimboza & Mutandwa, 2007).

### **1.3 Evolution of Smallholder Dairy Farming in Zimbabwe**

The first smallholder dairy scheme was introduced in Zimbabwe in 1983 as a tool for enhancing rural development and improving human nutrition (Musimwa, 1999; Francis & Sibanda, 2001; Ngongoni *et al.*, 2006; Zvinorova *et al.*, 2012). Introduction of smallholder dairy farming post-independence was mainly in response to the increased demand for fresh milk. At that time, milk shortages were being experienced, resulting in the rationing of milk products and banning of exports of milk and related products. During this period, the major milk producers were large-scale commercial farmers (Francis, 2000; Gran *et al.*, 2002; Munangi, 2007). Moreover, it was realised at that time that there was potential for smallholder producers to contribute towards satisfying the national milk demand rather than merely targeting them as potential consumers for processed milk.

Smallholder milk producing schemes were introduced as part of a broader national Dairy Development Programme (DDP). The DDP exists even today. It is designed to promote and coordinate milk production by smallholders whilst encouraging commercial orientation (Francis, 2000). The programme started off with 13 dairies namely Chikwaka, Clemonts, Gokwe, Hauna, Hwedza, Marirangwe, Mushagashi, Mzingwani, Nharira, Rusitu, Sadza, Shurugwi, and Tsonzo. To date, there are 30 smallholder dairy schemes spread throughout the country (Chimboza & Mutandwa, 2007). About 2 000 smallholder rural farmers were delivering milk to the 13 above mentioned dairies when they were first established (Gran *et al.*, 2002). The dairies were specifically established to enhance the income of the rural farmers, increase milk production and marketing. After their establishment, the dairy schemes were handed over to the farmers to run in the form of cooperatives. Individual farmers produce milk mainly with crop-livestock systems. The milk is delivered to a central collection centre on a daily basis before being processed and

marketed. Farmers are paid on a weekly basis for their contribution. A committee of members of the cooperative, which is member-elected on a yearly basis, oversees the management of the dairy processing plant or centre. Each centre employs persons who run its affairs. A farmer's participation in the dairy scheme is voluntary and one can exit at any desired point.

Considering that approximately 69 % of the population of Zimbabwe resides in rural areas and 40 % are prone to poverty (Gunjal & Pound, 2010), it can be argued that smallholder dairy farming has the potential to significantly contribute to the reduction of the identified challenges. The same Gunjal and Pound (2010) study also revealed that crop and livestock production were the primary sources of livelihoods in the rural areas of Zimbabwe. With the upsurge of the number of smallholder farmers in the country as a result of the land reform, the number of smallholder dairy schemes continues to increase.

The fact that there are plans to open up new dairy schemes in Zimbabwe (Garwe, 2007) makes it crucial to learn from the smallholder dairy schemes introduced in the past and are still operational. Nharira Dairy Scheme is one of them. The lessons learnt from that cohort of schemes would guide the growth and development of the new ones being mooted. However, it is vital that the lessons focus on checking if the existing dairy schemes are achieving the objectives set when they were established. For this reason, it is crucial to unpack the contributions of the smallholder dairy schemes to the livelihoods of participating households.

#### **1.4 Statement of the Research Problem**

Increases in the prices of food and other commodities in Zimbabwe coupled with the likelihood of them remaining high, make smallholder dairy farming an attractive option to provide a means for generating regular income and sources of livelihoods (WFP, 2014). There is evidence in literature on smallholder dairy farming that indicates that it brings various socio-economic benefits to participating households and improves the livelihoods of people living in rural areas (Francis & Sibanda, 2001; Bennet *et al.*, 2006; Mapekula *et al.*, 2009; Zvinorova *et al.*, 2013). However, none of these studies presents a holistic picture of the positive and negative changes in financial, human, natural, physical and social capital occurring in households involved in smallholder dairy farming. Furthermore, a number of studies in literature focus on the effect of livelihood capitals on household strategies (Alwang *et al.*, 2005; Fang, 2013; Zenteno *et al.*, 2013). However, none of these have explored the contribution of a livelihood strategy to the household capital portfolio. Without such knowledge, it is impossible for policymakers to put in place appropriate policies that ensure that individual households benefit from smallholder dairy farming. Moreover, this implies

that decision making with regards to dairy farming as a livelihood option is based on partial knowledge on the actual contribution to livelihoods that exists.

Regardless of the unavailability of information, the number of smallholder dairy farmers in Zimbabwe continues to increase (Chimboza & Mutandwa, 2007). This state of affairs necessitates building a deeper understanding of the contribution of smallholder dairy farming towards livelihoods, taking into account each one of the five capitals that anchor the sustainable livelihoods framework. Thus, in this study, the contribution of smallholder dairy farming towards individual household livelihood assets will be critically analysed.

### **1.5 Research Objectives**

The main objective of this case study in the Nharira area of Zimbabwe was to critically analyse the contribution of smallholder dairy farming towards achieving sustainable livelihoods within households involved in it. This was done in order to suggest relevant measures to improve the livelihoods of the smallholder dairy farmers. In order to achieve this aim, the following were the specific objectives of the study:

- a) To determine the socio-demographic, production practices, biotechnical and economic performance characteristics of smallholder dairy production within households;
- b) To identify the positive and negative contributions of smallholder dairy farming towards social and human capitals within households;
- c) To identify the positive and negative contributions of smallholder dairy farming towards physical, natural and financial capitals within households; and
- d) To suggest relevant practical measures to improve rural livelihoods through smallholder dairy farming.

### **1.6 Research Hypotheses**

Three hypotheses were tested in this study. These are listed below

- a) Smallholder dairy farmers in Nharira have the same socio-demographic, production, biotechnical and economic performance household characteristics;
- b) Participation in smallholder dairy farming results in increased levels of household social and human capitals; and
- c) Participation in smallholder dairy farming results in increased levels of household natural, physical, and financial capitals
- d) Practical tailor made measures can improve rural livelihoods

## 1.7 Theoretical Framework of the Study

Sustainable livelihood framework was adopted as the theory that guided this study. The framework targets at bringing about development that is economically, socially, institutionally and environmentally sustainable (Dervla, 2004). Sustainable livelihood theory is people-centred, responsive, participatory and dynamic. According to this framework, households follow various strategies as means of livelihood. Rural livelihoods may be derived from on farm and off farm activities which are usually natural capital based (Dadabhau & Kisan, 2013). The Sustainable livelihood framework is a conceptual structure that relates and brings out an understanding of the various livelihood options which are pursued by a household, particularly by poor households (Department for International Development (DfID), 2000). The framework helps to understand the way the poor derive their livelihoods (Serrat, 2010). Factors that affect livelihoods of people and the relationship among these, are presented in the Sustainable livelihood framework.

The sustainable livelihood framework postulates that a poor household is within a vulnerable context where various shocks, trends and seasonality affect livelihoods. However, a household responds to the shocks, trends and seasonality by using the livelihood capitals at their disposal (Serrat, 2010). These capital are classified as assets (human and social) and capabilities (natural, physical and financial). Usage and ownership of these assets is affected by the various institutions and processes within which the household is located. Assets inter-influence each other with the livelihood strategy opted for by a household. This all culminates to livelihood outcomes. A diagrammatic representation of the framework is depicted in Figure 1.1. Considering the complex and multiple dimensions which are presented by the sustainable livelihood framework, various study focal areas can be developed. As such, this study focused on the livelihood assets, outcomes and dairy farming as a livelihood strategy. According to the sustainable livelihood framework, there is a two-way relationship between the livelihood capitals and strategy. A household decides on a livelihood strategy depending on the level and combination of capital at their disposal. In contrast, participating in a specific livelihood strategy, in this case, dairy farming, produces outcomes which can be viewed through the lenses of household capitals. Further clarity on the linkage between the theoretical framework and the current study is given under section 2.7 in Chapter 2.

## 1.8 Operational Definitions of Key Terms and Concepts

In this study, a *smallholder dairy farmer* refers to a household that produces milk within a mixed crop-livestock system. Its main objective is to satisfy household consumption and selling surplus produce to a central milk collection establishment, in this case, Nharira dairy scheme.

Livelihood is a term used collectively to refer to capabilities (educational, skills, health, and networks), assets (material resources) and activities that a smallholder dairy farming household requires to earn a living.

Livelihood capital refers to a specific classification of capabilities and assets from which a household earn a living from. These are classified as financial, human, physical, social and natural capital.

In this study, “contribution” refers to the role that smallholder dairy farming plays towards enhancing or negating the livelihoods of households.

*Household* means a domestic unit that consists of people living together within the same homestead, including extended family members and domestic workers, who pool and share resources as well as cooking and sharing a meal.

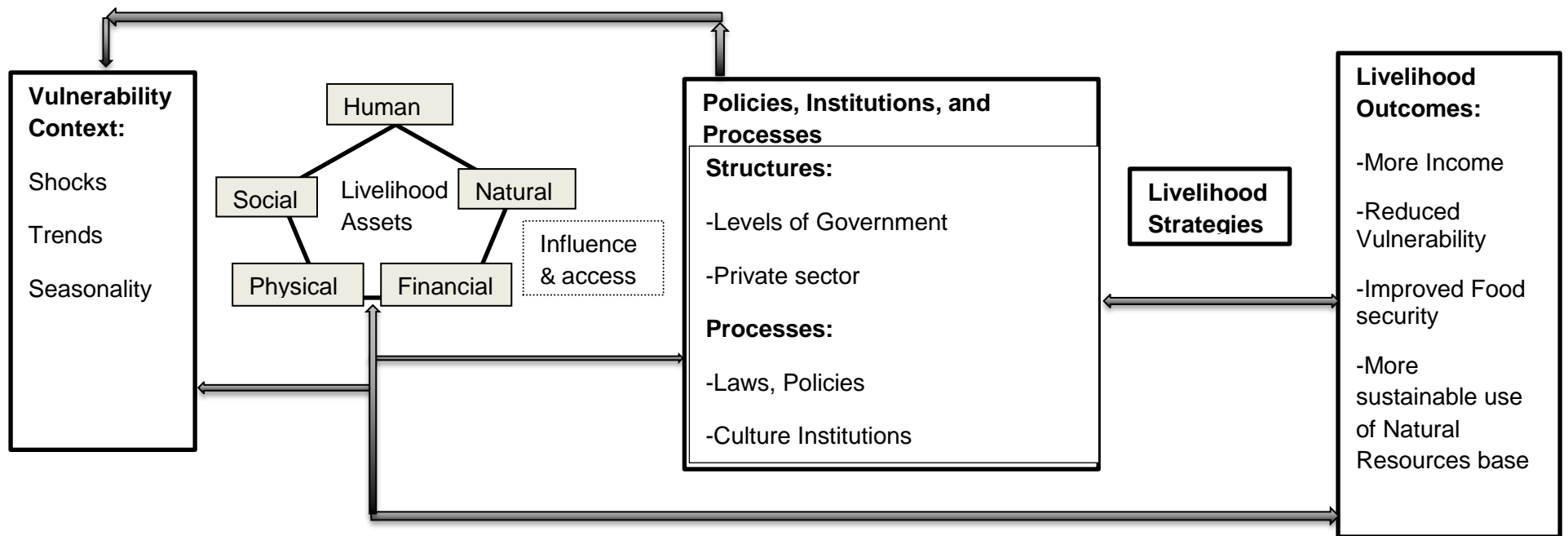


Figure 1.1 Sustainable Livelihood Framework (Source: DfID, 2000)

## 1.9 Outline of the Thesis

This thesis comprises seven chapters. Chapter one contains the background, which sets the scene for the study. Objectives and hypotheses that underpin the study are included. In Chapter two, the literature related to the study is reviewed. The literature encompasses international, regional and local perspectives. Literature on the methodologies used in similar studies is also reviewed. In the third chapter of the thesis, the methodological approaches used in the entire study are explained. In the chapter, description of the research design, methods, data collection and analysis tools and techniques, as well as ethical considerations applied for the study, is given. Chapters four, five and six are written in a paper format, that is abstract, introduction, materials and methods, presentation of results, discussion, conclusion, recommendations and references. Presentation of the current study findings and discussion with regards to the characterisation of smallholder dairy farmers in Nharira is given in Chapter four. Chapter five is a paper focusing on the contribution of smallholder dairy farming to livelihood capabilities (social and human capital) of households in Nharira. Contribution of smallholder dairy farming towards financial, natural and physical capitals is presented and discussed in Chapter six. Chapter seven is a summary of the key findings and associated synthesis of the entire study. Conclusions and recommendations of the study are also distilled. A list of appendices is included after Chapter seven.

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## **CHAPTER 2: REVIEW OF LITERATURE**

### **2.1 Introduction**

In this chapter, a review of literature on livelihoods and smallholder dairy farming within the context of rural development is given. Literature on a global, regional and local context is reviewed in this chapter. The chapter starts by exploring the state of smallholder dairy farming around the world. This is followed by a characterisation of smallholder dairy farmers according to biographic and socio economic factors, production practices and biotechnical performance. In this chapter, the contribution of dairy to rural livelihoods and the sustainable livelihood framework is also explored as the theory that guides the study. The chapter further delves into the various methods of measurement of livelihood capitals and ends with the conceptual framework applied for the study.

### **2.2 Global State of Smallholder Dairy Farming**

#### **2.2.1 State of smallholder dairy farming**

According to FAO (2010), global milk demands are increasing by 15 million tonnes per year and this increase is mainly experienced in developing countries. It is further estimated that 150 million households are involved in dairy farming with the majority of these being located in developing countries (Hemme & Otte, 2010). Annual milk consumption is on an increase from 3.5 to 4 % in developing countries (Hemme & Otte, 2010). Considering the increased consumption and demand of milk in the world, any contribution regardless of its size, made by any milk producer should not be overlooked. Satisfying this milk demand would take efforts of both smallholder and large scale farmers. In the process of satisfying the milk demands, the farmers also earn a living from the practise.

About 80 % of the milk in Asia is produced by smallholder farmers (FAO, 2008). India has about 27.6 million people who generate their income from dairy farming (FAO, 2008). About 70 % of the people who get their major livelihood income from dairy production are smallholder farmers (Nargunde, 2013). India dairy farming is playing an important role in sustaining the lives of smallholder producers in India (Nargunde, 2013). India is an exemplary country with regards to the success of dairy through smallholder initiatives. Smallholder dairy farming thus has a significant impact on the economy and wellbeing of the people in India. Though amounts produced by a single smallholder farmer might be small, the collective contribution is significant warranting state attention, in terms of support.

In Kenya, the dairy sector is also predominately smallholder, and these contribute 80% total milk production of the country (Meinderts & Omondi, 2009). Similarly to India, Kenya significant

number of smallholder dairy farming households derives their livelihoods from this production practise. Smallholder dairy production is known to have various benefits associated with it. Smallholder dairy producers benefit from their livestock as it serves as a store of wealth, draught power, fuel for prestige, organic fertilizer for crop production and a means of transport.

There are various ways and understanding of what a smallholder dairy farmer is. These understandings vary from region to region even within a country. Smallholder dairy can be defined according to farming system, number of cows, land size ownership and production practices followed by the farmer (Rangnekar & Thorpe, 2001). These dairy farmers produce milk from a wide range of animals, mainly cattle, buffaloes, goats and camels. India and Pakistan rely heavily on milk production from buffaloes (Hemme *et al.*, 2004). Unlike these two countries, Bangladesh relies heavily on cattle and also gets a significant amount of milk from goats (FAO, 2008). In sub-Saharan Africa, milk production for marketing purposes is mainly from cattle. However, goat milk is used for household consumption. However, for the purpose of this study, focus is placed on cattle as they are the animals used in the study area as the milk production assets.

Technological advancement in the dairy production sector is being applied in efforts to enhance milk productivity. Artificial insemination (AI) has been found to improve reproductive performance of dairy animals (Hemme *et al.*, 2004; Hemme & Otte, 2010). However, the challenge with the application of this technology among the smallholder farmers is the cost associated with it. For instance in Bangladesh, AI is only practised by smallholder farmers in the event of support from the government (Rangnekar & Thorpe, 2001). Even though AI is extensively used in developed countries as a means of improving the breed of dairy animals, a lot still needs to be done in developing countries in order to take advantage of this technology (Tefera *et al.*, 2014). The situation is even worse with smallholder farmers considering the cost associated with the practice. For AI to work for smallholder farmers there is need to find a way of minimizing the costs associated with this practice. A study carried out in Ethiopia by Tefera *et al.* (2014) reveals that educational level of the household head has a positive impact on the use of AI. This raises a further challenge for the dairy farmers in rural areas of developing countries.

## **2.2.2 Challenges faced in smallholder dairy farming**

Smallholder dairy farming is faced with various challenges which limit productivity and profitability of milk production. In the Asian and South Pacific region, a study carried out by FAO in 2008, reveals that the major constraint faced by the farmers are access to affordable credit, availability of feed, shortage of improved stock, lack of knowledge on dairy cow management practices. Inaccessibility of credit limits expansion of the smallholder dairy enterprises as smallholder farmers are usually cash constrained. Additionally, limited access to suitable credit and the

generally poor economic performance of a country limit development of smallholder dairy enterprises in sub-Saharan Africa (Muriuki, 2002). Availability of feeds challenge is faced as a result of the reliance on natural fodder which is dependent on the natural rain session. During the dry season, the fodder availability and quality deteriorates and thus affecting productivity of the dairy animals (Mapiye *et al.*, 2006; Klapwijk *et al.* 2014). As such, financial investment into the acquisition of animal feed would be required during this period. Such problems have also been found to be common in other regions of the world, particularly in sub-Saharan Africa (Francis & Sibanda, 2001).

Other challenges faced by smallholder farmers in addition to the above-mentioned challenges, feed quality, animal health management practices are also experienced in the region (Francis & Sibanda, 2001; Masama *et al.*, 2005). In Zimbabwe, the smallholder farmers' limitation to productivity lies within poor livestock management practices and feed quality (Francis and Sibanda, 2001; Zvinorova *et al.*, 2012). These challenges affect productivity to the point that some of the farmers experience balance sheet losses. However, since smallholder dairy brings many other benefits beyond financial gain, the households still continue to engage in the enterprise. The poor state of infrastructure in rural areas presents a mammoth challenge for the smallholder dairy producers. These infrastructures include roads, and water and electricity supplies, which limit the marketing efficiency of milk.

Successful smallholder dairy initiatives are accompanied by some form of institutional support which ensures that production environment and the markets are conducive for small producers (Saha & Haque, 2001). The support may be in the form of national policies which encourages market participation, encourage trade, and simplifies access to loans by smallholder farmers. In that view, Uganda has experienced growth in the dairy sector as a result of favourable macro-economic conditions, policy and institutional reforms, improved pasture and farm management practices (Bancie *et al.*, 2014). The smallholder dairy sector across the world also receives significant support from donor organizations (Hemme & Otte, 2010). These ensure that the small farmers own highly productive breeds of animals. This is achieved through donation schemes. Donors also play a huge role in the provision of dairy production information, in conjunction with the national extension services. This is evident in Kenya where Department for International Development (DfID) and the government collaborate to bring technologies and knowledge to the smallholder dairy farmers (Muriuki, 2002). Establishment of milking centres and processing centres have received significant support from the governments and donors as well.

Muriuki (2002), argues that Kenya, Tanzania, Uganda have a generally more smallholder dairy farmers as compared to Southern African countries such as Malawi, South Africa and Zimbabwe due to mid-altitude and monomodal rainfall agro-ecology, which favours disease proliferation and

low biomass production. This affects the quantities and quality of milk produced by smallholder farmers. Nevertheless, the farmers in the Southern African countries cannot be overlooked because they provide for their families through dairy, and also have a role to play in the dairy sector of their specific countries. Additionally, more focus should be placed on them in an effort to find a better way of production in the light of the challenges they are faced with.

## **2.3 Characterisation of Smallholder Dairy Farmers**

As earlier discussed, there is no agreed definition of smallholder farmer. Different regions, people and authors use different parameters to classify smallholder farmers. This section focuses on how smallholder dairy farmers are characterized according to socio demographic, production practice, biotechnical performance and economic performance.

### **2.3.1 Socio demographic characteristics**

Smallholder dairy farming is seen as a way in which women and youth living in the rural areas can earn some income (Nargunde, 2013). This is because these two social groups are mainly involved in the provision of labour for the smallholder dairy enterprise. This is in line with the finding of a study carried out in India and Sri Lanka which revealed that women are the main social group involved with smallholder dairy production (Ranaweera, 2007). Women contribute immensely towards agricultural production but are often unrecognized (Rangnekar & Thorpe, 2001). In smallholder dairy, women are involved in various activities which include decision making, milking, marketing and cleaning of facilities. Additionally, in Kenya it was noted that mainly women and children provide smallholder dairy labour, which includes milk production and marketing (Muriuki, 2002). The chores require waking up in the early hours so that they are able to go to school and carry out other chores during the day. This has raised some concerns relating to the distribution of farm labour across gender. However, children benefit nutritionally from milk production.

However with regards to youth, though dairy can be a means of alleviating the youth unemployment problem, a lot still needs to be done so as to encourage youth participation in smallholder dairy (Nargunde, 2013). The main challenge is with regards to ownership of the smallholder dairy enterprise, whereby youth mainly provide labour and, are not the proprietors of the enterprise. This challenge is evident in sub-Saharan Africa where the elderly continue participation in dairy farming without giving the youth an opportunity to solely run the enterprise. This is a challenge towards sustainability of the smallholder dairy farms.

Smallholder dairy farming plays a significant role in networks and relationships among producers and across players in the dairy industry (FAO, 2008). Networks among farmers are formed as in efforts to share knowledge, production and marketing strategies. Farmer to farmer networks are important as they serve as the first point of call in times of need. Sharing of information enhances farmer's confidence and social standing as new players in the business will be looking up to the experienced farmers for strategies. Networks also enhance market access and acquisition of good prices for products (Phong, 2008). This is because information will be flowing through various players and thus easily gets to the farmers enabling them to make informed decisions.

### **2.3.2 Production practice and biotechnical performance**

Smallholder dairy enterprises are usually faced with limited land availability (FAO, 2008; Chinogaramombe *et al.*, 2008). This challenge is exacerbated in the event that the farmer follows a mixed method of production as the dairy enterprise will be in competition for land, with other agricultural activities on the farm. The limited grazing land challenge affects the quantity of feeds available to a farmer. Farmers are sometimes not able to expand their dairy enterprise due to lack of adequate land for grazing coupled with limited finances to dedicate towards the acquisition of feeds from the markets.

Smallholder milk production is characterized by low input investment in Uganda (Garcia *et al.*, 2007). Likewise, the output obtained is also low. However, increased milk demand is forcing the smallholder producers to intensify so as to generate significant income from the enterprise (FAO, 2004). The intensification also includes the move from indigenous cattle breeds use to more productive breeds. Though, indigenous breeds are known to have some advantages especially with regards to adaptation to the local conditions and disease resistance (Zvinorova *et al.*, 2012). They however often lag behind in terms of quantity of produce.

Smallholder milk production can be carried out under various production systems. However, the most common one is the mixed crop livestock system (Ranaweera, 2007; Klapwijk *et al.*, 2014). A number of benefits are associated with the mixed crop livestock system and these include recycling of farm resources, reduced risk of crop failure and increased soil fertility (Dadabhau & Kisan, 2013). With this system, the livestock and crop enterprises have a symbiotic relationship. Crop residues provide feeds for the dairy cows and in turn, the livestock provides drought power for land preparation and manure which nourishes the soil. This system works well for the resource constrained farmers in rural areas, as it enables enhanced gain from each enterprise and provides an economical use for the crop residues. This, however, means that the crop and livestock will be competing for the available land considering its limited availability.

Studies carried out in various parts of Zimbabwe revealed that rangelands were the major source of feed for smallholder dairy cows (Ngongoni *et al.*, 2006; Ndebele *et al.*, 2007; Mapiye *et al.*, 2006). Smallholder livestock is mainly fed on natural pastures. However, the quality of the pastures is poor during some parts of the year. As such, smallholder dairy farmers in Zimbabwe also include supplementary feed (Masama *et al.*, 2003). These can be in form of home grown or commercial concentrates. Additionally, conserved fodder made from maize stover and groundnuts straws serves as feed for the lactating cow (Chinogaramombe *et al.*, 2008). Mineral blocks are also fed to lactating cows by the smallholder farmers who can afford them. A study carried out in Nharira reveals that almost all the smallholder farmers grew some fodder for their dairy animals (Mapiye *et al.*, 2006; Ngongoni *et al.*, 2006). The studies, however, indicates that not enough fodder is grown as a result of limited availability of land. Commercial concentrates are thus used to supplement and complement the natural and home grown fodder. These, however, are the main expenses incurred by the smallholder dairy farmers (Francis, 2000). High costs are unfavourable for smallholder farmers who are often faced with limited financial availability.

Francis and Sibanda (2001) are of the view that protein quality and feed resource quantity are one of the major challenges hindering smallholder dairy production in Zimbabwe. Additionally, farmers are also faced with small herd size, inappropriate breeds, poor feeding management and low fertility (Masama *et al.*, 2003). To ensure the development of smallholder dairy farming sector, such challenges need to be addressed.

### **2.3.3 Economic performance**

Smallholder milk production can be viewed as a cash crop which converts crop residues, low-value agriculture by-products, and farm household labour into a value added commodity (Nargunde, 2013). According to a study carried out in India by Nargunde (2013) indicates that smallholder dairy production offers better economic returns and efficiency in comparison to crop production. The study further indicates that smallholder farmers, who integrated dairying and crop production with irrigated land, were more profitable than crop farming alone. As such smallholder dairy provides a viable option for a source of livelihoods for the farmers.

Depending on the cost of production incurred, different regions require varied dairy herd size to break even. In Vietnam, a smallholder farmer breaks even at herd size of 10 (Phong, 2007). This can be considered a large herd size in comparison with other regions. A study carried out in Bangladesh revealed that smallholder farmers with as few as two cows are in a position to cover the full economic cost of production with a milk production cost almost as low as the large scale producers (Hemme *et al.*, 2004). Even though these smallholder farmers are competitive on a

national level, such is not the case on an international level. Both the smallholder and large scale producers in Bangladesh incur production costs which are almost 50% more than the large scale producers in India, Pakistan and Oceania (Hemme *et al.*, 2004). As a result of this high cost of production in Bangladesh, it is very difficult for the smallholder farmers to enter into international markets. Additionally, for the smallholder farmers to remain viable there would be a need for market policies and regulations to protect the local producers. On the other hand, India and Pakistan incur lower production cost as compared to USA, New Zealand and Western Europe (Hemme *et al.*, 2004). This favours international milk trade in these two countries as they are competitive.

The cost of production of milk by smallholder farmers differs from region to region across and within countries. Hemme, *et al.* (2004), argue that the main cost component incurred by the smallholder farmers is the opportunity cost of household labour. This argument applies possibly in regions where feeds are readily available throughout the whole year on a range system where the farmers need to employ a lot of labour to care for the animals. In contrast, a number of regions (Zimbabwe, Uganda) have identified the cost of feed as the main cost incurred by the smallholder producers (Ngongoni *et al.*, 2006; Chinogaramombe *et al.*, 2008). This is because of the seasonal availability of the right quantity and quality of the feeds which calls for supplementation. Additionally, there is a lack of appropriate economical technology on the optimum use of local feeds.

## **2.4 Contribution of Dairy Farming to Rural Households**

The Food and Agriculture Organization (FAO, 2010) underlines the fact that the smallholder dairy development sector plays a critical role in poverty reduction, particularly in rural areas. A study carried out in Bangladesh by Hemme, *et al.* (2004), indicates that in addition to earning of increased income, smallholder dairy farming enables the farmers to move from subsistence to a more market-oriented approach. Smallholder dairy farming is known for its various benefits to the rural household. Among the benefits is its contribution to food security and nutrition by means of providing protein to the human diet (FAO, 2008; Klapwijk *et al.*, 2014). Additionally, smallholder dairy farming provides a regular source of household income through milk sells while in the process creating employment for either the middlemen or the milk processors (Uddin *et al.*, 2012). Generally, smallholder dairy farming can be seen as a tool to generate a village micro economy, income and alleviate poverty in rural settings.

Dairy farming contributes to the livelihoods of smallholders. Smallholder farmers, especially those who practise mixed methods benefit more from the flow products, such as milk, draught power, manure; as compare to the end products (meat and hides) (Rangnekar & Thorpe, 2001; Klapwijk

*et al.*, 2014). This is because gaining from the end products implies that the farmer would have permanently lost ownership of their livestock and thus, the flow products are preferred. Individual households acquire income from the products of dairy which is used to meet household expenses, insurance, investment and other needs. These benefits are considered to last for as long as the cows are still owned by the farmer (holding the milk quantity produced per age of animal as a constant).

According to Nargunde (2013) smallholder dairy farming contributes to personal hygiene and cleanliness. This is achieved as an after effect of continually practising cleanliness and hygiene during milking and milk collection processes. The hygienic practises contribute a lot to the well-being of the household and disease prevention. However, such a benefit is often overlooked with focus being placed on direct benefit, regardless of its importance. As such the contribution of smallholder dairy farming comes in multifacets and can only be fully comprehended after a thorough examination of the matter.

## **2.5 The Sustainable Livelihoods Framework**

The sustainable livelihood framework is an analytical approach which depicts various aspects which are necessary for the eradication of poverty (Krants, 2001). The framework highlights the various relationships which shape sustainable livelihoods. A diagrammatic representation of the framework is shown in Figure 1.1. The key elements of the framework are discussed below:

### **2.5.1 Key Elements of the Sustainable Livelihoods Framework**

Vulnerability context is the external environment which the households exist in such as economic trends, theft shocks and seasonality (Scoones, 1998). However trends, shocks and seasonality do not always bring negative effects on livelihoods. People have little or no control over the vulnerability context.

Livelihood assets or capitals is the base or strengths from which people build their livelihood strategy from (DfID, 2000).

Livelihood strategy is the different routes and options which people take in order to satisfy their livelihood goals. This means that a household can have a number of livelihood strategies. Asset ownership, policies, institutions, and policies determine the livelihood strategy opted for (DfID, 2000). Additionally, livelihood strategy for one household may affect the strategy for other households. This is common in rural livelihood strategies which commonly base on natural resources which are common property.

Livelihood outcomes are results or achievements derived from livelihood strategy opted for by a household. Examples of such are depicted in Figure 1.1.

## 2.5.2 Social capital

Social capital is a resource consisting of social relations shaped by norms of trust and reciprocity. It is a collective action resource which enables achievement of a livelihood outcome. According to Coleman (1986) and Putnam (1993), social capital has the ability to enhance economic well-being, democracy, and human capital. Social capital can be measured on an organizational, community, or individual level. Studies which focus on social capital at individual level bring out a lot more data as individual level, community level and household related questions can still be asked to the respondent rather than examining a particular community more directly. It brings out a better picture of social capital in the lives of individuals and families in the process also indicating the level and distribution within an area.

The social capital indicators can either be proximal or distal (Stone, 2001). Proximal indicators are outcomes of the components of networks, trust and reciprocity. Distal indicators are the outcomes not directly related to key components of social capital. These fall under other categories of livelihood capitals and thus avoid overuse of and repetition of the same measures, it is better to use the proximal indicators.

Social capital encompasses both formal and informal networks of social relations. This capital is developed through networks and connections within and across households and communities (Serrat, 2010). Such relations increase trust and the ability for collective action of the people involved. Membership to formal groups also contributes to the enhancement of social capital. Social resources are also developed through trust, reciprocity and exchange which enhance cooperation, bargaining power among groups (Scoones, 1998). Social capital enhances access to other forms of livelihood capitals through the collective action power. Even though social capital can play a vital role towards livelihoods, if not appropriately taken advantage of it can result in undesirable consequences. For example, networks may be based upon top-down relationship that can limit individual growth and development.

Social capital can be classified as bonding, bridging or linking (Bryant & Norris, 2002). Bonding social capital relates to the networks which exist within a group or individuals who are the same and within the same societal level. Bridging social capital relates to the networks that exist among people who are different but within the same societal level. Linking social capital is the networks that exist across different societal levels.

There is no agreed upon measurement methods or variables for social capital. Social capital is difficult to measure directly and thus, proxy indicators are used (Grootaert *et al.*, 2004). Even

though proxies are used, there is still no agreed upon set of indicators. Indicators used in the measurement of social capital depend on the geographic and sectoral context of the study (Grootaert & van Bastelaer, 2001). The scope and depth of the unit under analysis also determines the proxy indicators used of measurement of social capital. More discussion on social capital is presented in Chapter five.

### **2.5.3 Physical capital**

Physical capital encompasses infrastructure and basic production resources required to support a livelihood (Scoones, 1998). This includes roads, transport, housing and telecommunications. Infrastructure usually is owned by the government and are accessed free of charge with a few exceptions where a service fee is expected. Production resources are owned by individuals or groups and it is the owner's responsibility for their upkeep and maintenance. Inefficient or poor production resources affect the quality of the produce; result in gross inefficiencies and reduction of the productive capacity of individuals (DfID, 2000). Poor access to physical capital, particularly infrastructure has a negative gross effect on access to other livelihood resources. Some poverty measures use the availability of some infrastructural assets as a core dimensional measure of poverty (Serrat, 2010).

In analysing physical capital, key issues to address include the appropriateness of infrastructure, access and the level of support to service provided by the infrastructure. Mayunga (2007) and Wang (2015) measured physical capital through assessing the productive equipment and basic infrastructure of households. This method classifies all the variables for physical capital under the above mentioned two categories. Further clarity on the measurement of physical capital is given in Chapter 6.

### **2.5.4 Financial capital**

Financial capital encompasses cash and cash equivalent resources available to households which are used to generate and sustain livelihoods (DfID, 2000). These can take the form of savings, credit, pension, remittances and cash. Financial capital can be classified into two categories namely available stock and regular inflow income. Available stock includes cash in hand, bank, cheques, and liquid assets such as livestock. Regular inflow income includes remittances, pension and grants. Financial capital is the most flexible as it can be easily converted into any of the other capital. This implies that its availability can be an indication of the potential access to other forms of assets if supporting institutions are functional. However, this capital is usually very limited within rural households. Additionally, ownership of financial capital alone does

not solve the poverty challenge as a lack of knowledge may impede the appropriate and effective use of the capital. A balanced combination of the livelihoods assets is the preferred condition.

In analysing financial capital, there is need to know the type of financial services available, the kind of service they provide and how they are accessed (Hemme, *et al.*, 2004). It is also of importance to understand the nature of saving of the household and the flow of remittance income. Yussuf (2016) and Bhandari (2013), identified three categories through which financial capital can be fragmented for measurement purposes. These categories are household income, savings and investments and access to financial services and aid.

### **2.5.5 Human capital**

Human capital encompasses the skills, knowledge, capabilities and health conditions which enable one to take up various livelihood strategies (Serrat, 2010). Even though all forms of capitals are important, human capital plays a central role because it influences access and use of the other capitals. The amount and quality of human capital shape the livelihood outcomes. Accumulation of human capital is through direct and indirect means (Adato & Meinzen-Dick, 2002). Human capital is acquired directly through the attending school, workshops or some form of training which enhances one's intellectual capacity. This requires an individual who is willing and able to invest in their own development, indirect accumulation of structures and processes which enhance transformation.

Human capacity can be analysed by use of various indicators. These include life expectancy, education indicators (years spent in school, quality of education received), leadership potential, and available local knowledge. Human capital is difficult to measure direct just like social capital. As such, proxy variable are used to measure human capital. The World Economic Forum (WEF) (2013) views human capital as through four subclasses and these are education, health and wellness, workforce and employment and enabling environment. However, these are not rigid as they keep changing with time and more research. Chapter five and Table 2.1 highlights more insights on measuring human capital.

### **2.5.6 Natural capital**

Natural capital is resource stock available naturally within an environment and is useful for livelihood derivation. These include soil, water, air, genetic resources, and forests. This resource is of particular importance to households residing in rural areas because they derive their livelihoods from it (Scoones, 1998). The livelihood options offered by natural capital include agriculture, fishing, selling firewood, mining and fruit gathering. Of particular interest to this study

is the derivation of agricultural based livelihood from natural capital. With smallholder dairy farming, the resources, land, in particular, provides for grazing land, which is a cost effective method of feeding the animals (Adato & Meinzen-Dick, 2002). However, natural capital brings about the most devastating shocks to livelihoods which are natural processes. These include fires, earthquakes, floods, climate change. Natural capital is also affected by the changes in season which affect its quality and availability during some parts of the year.

Natural capital supports the functioning of other forms of capitals and the success thereof is based on the wellbeing of complex ecosystems (Adato & Meinzen-Dick, 2002). To understand natural capital better, there is need to know the availability, access, quality and how access varies over time. Evaluating natural capital from an environmental economist point of view takes account of direct use, indirect use and non-use value. However, Bhandari (2013) suggest that measuring the natural capital involves focusing on the flora, fauna, land, water, air and environmental services stock and access by a particular household. Such a method views natural capital with respect to access and stocks available to the household.

There has been the identification of additional livelihood capitals beyond the ones identified by sustainable livelihood framework. There is an ever increasing list of capitals which are suggested by various fields. In addition to the five livelihood capitals identified by the DfID (2000), cultural, intellectual, environmental, political and spiritual capital are also suggested (Schuller, 2001). However, these additional capitals if carefully examined, are found to be part of the five DfID identified capitals. For example, political capital and cultural capital can easily fall under social capital depending on the definition used. Environmental capital can fall under natural capital, whilst intellectual capital can be part of human capital. Political capital includes citizenship, membership in political party and empowerment (Adato & Meinzen-Dick, 2002). A thorough examination of political capital will show that some of its aspects are encompassed in other forms of capitals. For example membership in a political party can easily fall under social capital. Spiritual capital includes imagination, intuition and persistence of which are inner capabilities within an individual (Chu, 2007). If examined clearly, though, these shape the access and disposal of other forms of capitals. Additionally, this form of capital is challenging to measure. Consequently, spiritual and political capital will not be considered for this study.

### **2.5.7 Methodologies for Sustainable livelihoods Framework**

The sustainable livelihood approach is applied in many different contexts to gain an understanding of the poor and how they make a living for the various capitals which are at their disposal. However, in applying this framework, there are challenges which are often faced with regards to

the analytical methodologies for various components of the approach (Carney, 2003). This often makes it difficult to apply for the users who are new to the framework, regardless of the appealing nature of the framework. The framework does not give a clear outlay of how the various components can be measured.

This challenge is viewed differently by the more experienced users who interpret the lack of clear methodologies as leeway to apply various existing analytical tools and flexibility depending on the context in question (Carney, 2003). Another group of users is of the view that there is a need to develop a set of methodologies which are directly linked to the framework and better explain how assets are used and substituted. Table 2.1 explains some of the methodologies used to measure the livelihood capitals in various studies.

The sustainable livelihood framework has been used to in multi-disciplines of study. Studies and project applying the sustainable livelihood framework focused on various dimensions such as rural tourism, contribution of forest products performance of irrigation systems, assessing entrepreneurship, access to livelihood capitals by migrants, rural livelihood change, assessment of mountainous settlement agriculture, livelihood diversification, livelihood asset ownership and its relationship to household strategy (Adato & Meinzen-Dick, 2002; Shivakoti & Shrestha, 2005; Fang *et al.*, 2014; Kamaruddin & Samsudin, 2014). Even though the sustainable development has been applied in various disciplines and studies, not much evidence exist for its application in understanding the contribution of smallholder dairy farming to livelihoods. Furthermore, various dimensions of the framework have been explored through the above-mentioned studies, however, none of the studies focuses on the impact of a livelihood strategy on household capitals.

## **2.6 Smallholder Dairy Farming Policy Framework**

Smallholder dairy farming emanated as a result of the Dairy Development Programme established in 1983 by the government as a way of encouraging smallholder farmer participation in dairy production and markets (Mupunga & Dube, 1992). As a result of this policy, the government established infrastructure in support of the dairy activities within different parts of the country. The established infrastructure includes milking centres, roads, electricity and dips (Hanyani-Mlambo *et al.*, 1998). These encouraged the smallholder producers to venture into dairy.

**Table 2.1: Measurement of livelihood capitals**

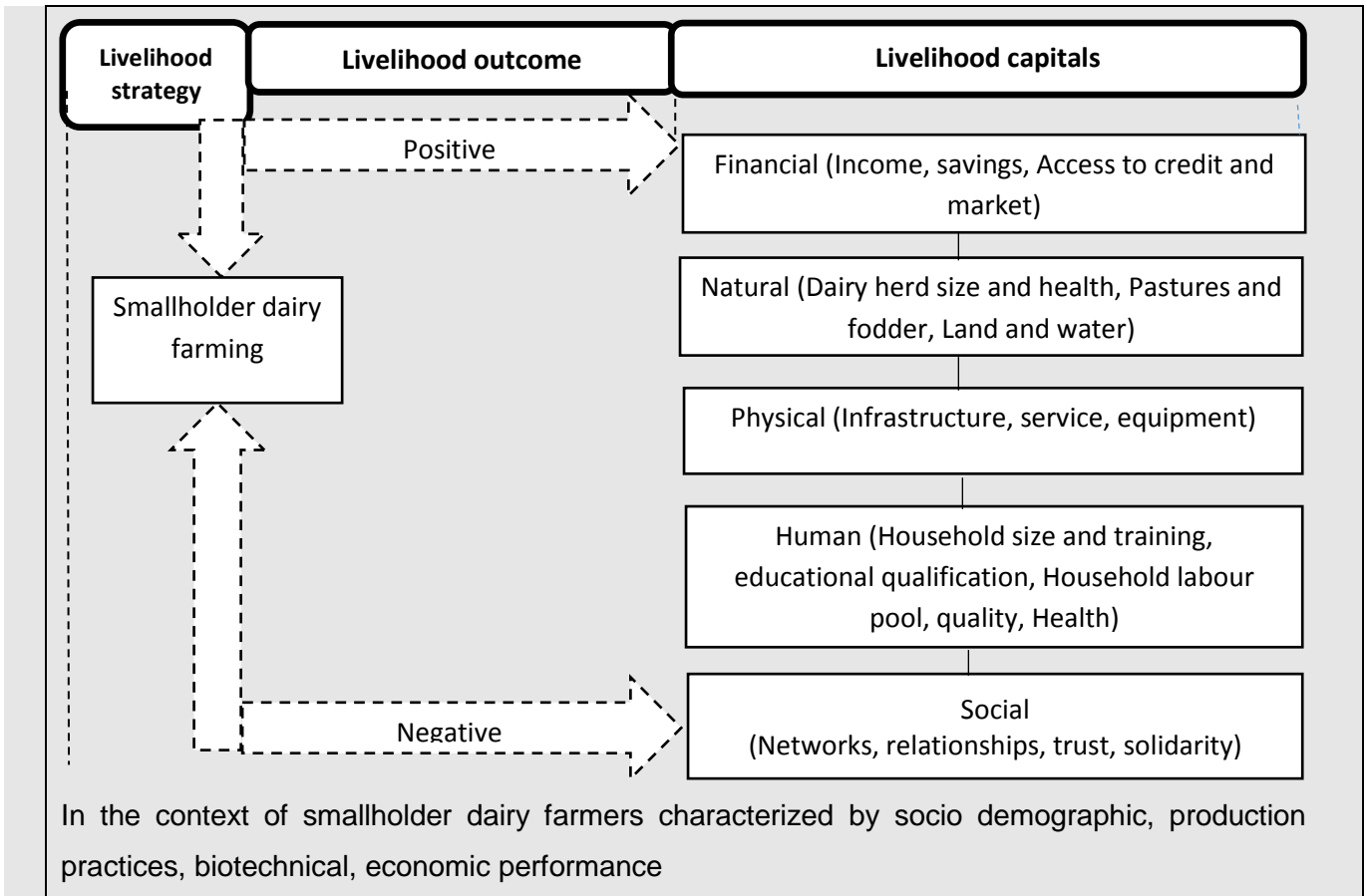
Type of capital	Key components or descriptors	Measurement methods and techniques	Comments (Merits and demerits)
Social	<ul style="list-style-type: none"> <li>Structural social capital (configuration of networks of acquaintances e.g. number of ties)</li> <li>Relational social capital (which describes the strength of ties (e.g. trust))</li> <li>Cognitive social capital (which represents the mutual understanding that is achieved through shared norms and language)</li> </ul>	<ul style="list-style-type: none"> <li>Likert-type scale</li> <li>Cross tabulation (Grootaert <i>et al.</i>, 2004)</li> <li>Multivariate models</li> <li>Social capital index</li> </ul>	<ul style="list-style-type: none"> <li>Simple and convenient way to organize data and to extract the basic messages contained in data set</li> <li>Few variables can be tabulated at a time</li> <li>Multivariate identify the contribution of social capital to household welfare in relation to other household assets.</li> <li>A key concern: direction of causality is not shown</li> </ul>
Financial	<ul style="list-style-type: none"> <li>Income from farming</li> <li>Income from other economic activities</li> <li>Rental income</li> <li>Savings</li> </ul>	<ul style="list-style-type: none"> <li>Capital index (Financial capital index)</li> <li>Multivariate models</li> <li>Qualitative measure</li> </ul>	<ul style="list-style-type: none"> <li>Some variable of the capital cannot be quantified so as to fit into the index</li> </ul>
Physical	<ul style="list-style-type: none"> <li>Agricultural equipment</li> <li>Water source</li> <li>Housing</li> <li>Transportation</li> <li>Entertainment</li> <li>Sanitation</li> <li>Kitchen appliances</li> </ul>	<ul style="list-style-type: none"> <li>Capital index (Physical capital index)</li> <li>Multivariate models</li> <li>Qualitative measures</li> </ul>	<ul style="list-style-type: none"> <li>Qualitative measures do not give clearly define distinction between various categories</li> <li>Scaling the variables enables comparability</li> </ul>
Human	<ul style="list-style-type: none"> <li>Education level</li> <li>Literacy</li> <li>Labour (agricultural and skilled wage labour)</li> </ul>	<ul style="list-style-type: none"> <li>Capital index (Human capital index)</li> <li>Human Development Index</li> <li>Multivariate models</li> <li>Qualitative measures</li> </ul>	<ul style="list-style-type: none"> <li>Multivariate identify the contribution of social capital to household welfare in relation to other household assets.</li> </ul>
Natural	<ul style="list-style-type: none"> <li>Land (owned and lease)</li> <li>Livestock</li> <li>Water source</li> <li>Access to energy</li> </ul>	<ul style="list-style-type: none"> <li>Capital index (Natural capital index)</li> <li>Multivariate models</li> <li>Cross tabulations</li> <li>Quantitative measure</li> </ul>	<ul style="list-style-type: none"> <li>Cross tabulation is simple and convenient way to organize data and to extract the basic messages contained in data set</li> <li>Few variables can be tabulated at a time</li> </ul>

Of late, the Government of Zimbabwe (GOZ) came up with an economic blueprint, Zimbabwe Agenda for Sustainable Socio Economic Transformation (ZimASSET) 2013- 2018, focusing on people-centred governance (GOZ, 2013). This plan targets to achieve sustainable development, empowerment and wealth creation through efficient and effective utilisation of the country abundant resources, particularly human and natural. Smallholder dairy farming is another way of effectively utilising the natural resources so as to create wealth for people living in rural areas. The ZimASSET plan identifies four strategic clusters and the one of particular interest is the food security and nutrition cluster. Considering the contribution of smallholder dairy towards household nutrition, it can be a pathway to achieve this strategic goal.

## **2.7 Conceptual Framework of the study**

The study concept is derived from the sustainable livelihood framework. The study conceptualize that the households are involved in smallholder farming as a source of livelihood. This livelihood option is shaped by the livelihood assets which the farmers have at their disposal (Figure 2.1 below). As the farmers practice dairy, the amount, quality and access to the livelihood assets are affected, either positively or negatively. This effect will be the livelihood outcome derived from dairy farming. However, all this happens in the context of people (smallholder dairy farmer) who have different social demographic and biotechnical characteristics; production practices; and economic performance. These characteristics also have an impact on the decisions made by the farmers and the livelihood outcomes obtained.

Focus was placed on the five livelihood assets namely financial, physical, human, social and physical capital. The specific variables which were examined are categorized according to the breakdown shown in the conceptual framework (Figure 2.1). From the Figure 2.1, the study aimed at unearthing the relationship between smallholder farming and the livelihood assets. The study also revealed the changes to these assets as a result of the smallholder dairy farming. The current study focused on three aspects of the sustainable livelihood framework and these are livelihood strategy, outcomes and household capitals. In this study, it is postulated that a household takes up smallholder dairy farming as a livelihood strategy. However, participation in smallholder dairy activities has some impact on the level and status of the various livelihood capitals. The impact can either be positive, negative or both. Though a number of positive contribution of dairy farming to a participating household are known, the negative side has not been explored much. In addition, the positive contribution has not been classified according to livelihood capitals.



**Figure 2.1: Conceptual framework of the current study**

## 2.8 Summary of Literature Review

In this chapter literature on smallholder dairy farming as a livelihood improvement strategy was reviewed. It was revealed that smallholder dairy farmers play a significant role in meeting the increasing global milk demand. However, smallholder dairy farmers were classified differently from one region to another. Smallholder dairy farming enabled women and youth to earn income and become empowered. It can be concluded that smallholder dairy farming plays a vital role in improving the livelihoods of people living in rural areas. It is however not clear how the benefits associated with the livelihood capitals of participating households are distributed according to the livelihood capitals. Gaps in literature were identified in terms of the application of sustainable livelihood framework on smallholder dairy farming projects. In addition, there exist a gap on assessment of the contribution of livelihood strategies on household capital. Although smallholder dairy farming was proliferating in various parts of the world, there were various challenges that needed to be addressed in order to enhance its growth and development.

The study is conceptualised from the sustainable livelihood framework focusing on the livelihood assets, capabilities, outcomes and smallholder dairy farming as the livelihood strategy. The sustainable livelihood framework gives a multi-dimensional view of the benefits derived from smallholder dairy farming. The framework does not give a clear outline of how livelihood capitals are measured and assessed. This gave more options to the researcher with regards to the kind of analysis which can be carried out for the study.

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## CHAPTER 3: RESEARCH METHODOLOGY

### 3.1 Introduction

In this chapter, the detailed methodology used in this study is outlined. Moreover, a description of the study area is given. The design and methods that were used in the study are explained. Furthermore, the population and study participants are identified and are linked to the specific data collection method utilised. Thereafter, the data collection methods, tools and techniques applied for the study in relation to the objectives are presented. Also included in the description are the ways in which validity and reliability were ensured. Ethical considerations and procedures followed are also outlined.

### 3.2 Description of the Study Area

Nharira is a rural area in Chikomba District of Mashonaland East Province of Zimbabwe. It is located in agro-ecological zone III (Mapiye *et al.*, 2006) which is characterised by low-medium rainfall (650-800 mm annually) and high temperatures (15-30 °C) (Mapiye *et al.*, 2006). The area receives approximately 160 crop growing days during the rainy season. Mid-season dry spells are experienced in the area, which makes it marginal for crop-based enterprises. The area has light-textured sandy-loam soils that are sparsely covered with indigenous trees and tall tufted grasses. Livestock production and drought-tolerant food crop production are the main farming systems practised in the area. According to Mapiye *et al.* (2006), the common dairy breeds that the smallholder farmers keep in Nharira are Red Dane, Friesian, Jersey, Crossbreeds and Indigenous (Mashona).

Nharira dairy was established in 1986 with a membership of 20 farmers. Currently there are 43 members of the dairy scheme, 21 of whom are smallholder communal farmers. The rest of the farmers are small-scale commercial dairy farmers. The dairy processing centre is located at Nharira growth point (Figure 3.1). A growth point is a rural or urban settlement that local government (District Council) earmarks and regards to have potential for development and as in need of public and private investment (Chirisa *et al.*, 2013). Both small-scale commercial and communal area farmers who reside within a 30 km radius from the dairy centre supply milk to the centre.



Figure 3.1: Map of Zimbabwe showing the location of Nharira dairy scheme, Chikomba District of Mashonaland East Province Source: (Ezilon Maps, 2014)

### 3.3 Research Design

A sequentially integrated mixed method design was used in this study. This was adopted because of its inherent strength of ensuring better understanding of the problem than the quantitative or qualitative method alone could provide (Wittink *et al.*, 2006). The sequentially mixed method design enables quantitative and qualitative phases to be carried out successively (Creswell, 2013). Two phases were designed and carried out for the current study. The first phase was mainly explorative and qualitative in nature so as to get the insights on the contribution of smallholder farming to livelihoods. During this phase, focus group discussion, key informant interviews and participatory mapping were carried out. After the first phase, the result were captured, analysed and used to inform the development of a household questionnaire. The second phase was mainly quantitative and confirmatory in nature. During this phase, household interviews, household visits and record reviews were carried out. Data collection tools for the second phase are designed in cognisance of the context which was established in the first phase to ensure that a context relevant data collection tool is designed for the second phase (Creswell, 2013).

According to Creswell and Plano Clark (2011), sequentially integrated mixed method design gives a complete understanding of the matter in question and also enables corroboration of results from different methods. This design also enables comparison of data from different respondents at multiple levels. As such, this method was used for this study, and equal weight was placed on both the quantitative and qualitative strands.

### 3.4 Community Entry

The initial steps of this project were partaking in community entry activities and seeking permission to carry out the study from the Nharira dairy management committee and the farmers. This was achieved through a triangulation of community entry activities. Community entry activities are vital for active involvement of research participants through establishing trust and working relationships (Ardichvili *et al.*, 2003). In this study, the first step in achieving community entry were telephonic calls which were made to some of the prominent farmers by one of the current research study promoters, who took advantage of his previous working relationship in the area. This provided a first contact point with the study area. A reconnaissance trip was then carried out in order to get first hand experiences of the realities of the area so as to plan the research activities accordingly. During this trip, an informal meeting with the secretary of the dairy scheme and another farmer was held. Plans for carrying out the research were shared with the above mentioned individuals who expressed their willingness to participate and also further

clarified some aspects on how the farmers and the dairy scheme operate. After this visit, the study focus was refined and adjusted to suit some of the insights which had been observed.

A further community entry visit was carried out after refining of study focus. This was meant to officially clarify the study and request permission to work with the farmers. During this step, a brief meeting with the chairperson of the dairy scheme, who was in company of two other farmers, was held. He was quick to give his approval to carry out the study with the dairy farmers. He indicated that there was no need for seeking any further permission. He also extended an invitation for the researcher to attend an annual general meeting which was scheduled for all active members of the dairy on the 4th November 2015. At the beginning of the annual general meeting for all the registered farmers for Nharira Dairy scheme, time was spared for introducing the study to the 30 farmers present. The farmers were a combination of smallholder farmers and small-scale commercial farmers. In addition, this opportunity was utilised to ask for further permission to carry out the study from the farmers and also to provide clarity on ethical issues (voluntary participation, privacy and harm). The farmers were excited about the research and approved the study.

Proposed timelines for the study were shared with the farmers who then modified them according to their individual schedules. The meeting then continued on to the usual order of business. However, the researcher was given an opportunity to sit in the meeting in order to get acquainted with some of the issues and experiences that the farmers faced. Informal interaction with some of the farmers after the meeting helped in establishing trust and connection with the farmers. All the above-mentioned activities enhanced trust and incited the farmers to participate in the study. According to Ardichvili *et al.* (2003), community entry helps prevent participants shying away from the study due to fear of criticism and not being sure of the relevance and accuracy of their contribution to a particular discussion. Ochocka *et al.* (2013) further state that community entry processes are useful beyond gaining access and recruitment of study participants, but encompass the establishment of ongoing engagement throughout the research process.

Potential data collection assistants were also identified in the process. These assistants played a role in disseminating information about the study, aiding in social preparation and providing information on the location of the study participants. After getting the clearance to carry out the study, two research assistants were recruited and trained. Training was carried out to ensure that the research assistants were clear about what they were expected to do and were better informed about the study. The research assistant team comprised of two youth who are involved in dairy farming in Nharira.

Training the research assistants was followed by pretesting data collection tools. Pretesting is done to identify and correct wrongly worded or vague questions before the actual data collection stage. Pretesting was done in two ways. Firstly, after construction of the data collection tools, subject matter experts in the form of thesis promoters critically examine them. This was done to ensure that only appropriate questions were asked in a manner that did not exhibit emotions and biases of the researcher. Secondly, pilot testing was done on the first day of data collection. Few changes were made to the questionnaire post pilot testing. This was followed by the data collection phases. Qualitative data collection preceded quantitative data collection. The qualitative phase made use of participatory social mapping, key informant interviews, focus groups and discussions. In the following quantitative data collection, individual household level questionnaires and record review tables were employed.

Data collected from the qualitative phase was captured and analysed and the results were used in the development of a questionnaire used during the quantitative phase. Analysis from the two data collection phases was done separately, though results were later merged to give a comprehensive report on the findings. During the merging process, similarities and differences were identified and further analysis was done to resolve the anomalies. Figure 3.2 outlines the research design in a flowchart nature.

### **3.5 Description of Study Respondents**

The respondents were smallholder dairy farmers participating in the Nharira Dairy scheme. A census of the 21 smallholder farmers was conducted using a formal household survey questionnaire. A census was utilised in this study because the population was small enough to be included without colossal financial and time input. Moreover, collecting data from a census is important for obtaining accurate and complete information (Shannon & Bradshaw, 2002). Considering the small population size, carrying out a census was deemed a strategy to hedge against the feeling of exclusion on the part of non-sampled farmers. This was to avoid dividing the community in the process of carrying out the study.

All the smallholder farmers and members of their households were invited to take part in the focus group discussion and participatory mapping. However, only 14 individuals participated in the activities. Four key informants were identified and interviewed. These encompassed the dairy scheme management chairperson and secretary, extension worker and one of the successful farmers. These were identified to further inform and validate the data collected. High participant turn out rate is attributed to the thorough community entry activities.

### **3.6 Data Collection**

Data were collected through a triangulation of methods and tools. Triangulation of tools enhances the validity of the data collected. Additionally, it ensures that a wider scope of people provide the data which will inform the findings of the study. Triangulation of methods and tools ensures a better understating of the research question as compared to when one method is used (Flick, 2016). Table 3.1 provides a summary of the data collection tools, techniques, study participants and objectives of the study. The data collection techniques and tools used in the study are expounded below.

#### **3.6.1 Focus group discussions**

A focus group discussion forum was organised in order to collect data on dairy farming as a livelihood option. In addition, data was collected on dairy farming practises. This was used as part of phase one of data collection. Focus group discussions were utilised during the exploratory phase of the study, to gather data to inform phase two. A focus group discussion is an interview which is designed to be undertaken by between 8 to 12 people who, in a group, deliberate on a specific topic (Krueger & Casey, 2009). The advantages of using this data collection tool are that the discussions are kept in the right direction and that all participants are encouraged to participate by the facilitators. This was necessary for the current study as the participants knew each other and could easily have switched to discussing their social issues without responding to the focus groups questions. Focus group discussion also enables participants to interact and come up with ideas that they would not have come up with if interviewed individually. Using this tool also enables the researcher to capture non-verbal behaviour which can be used as research input.

As stated above, all the smallholder farmers participating the Nharira dairy farming scheme and their household members were invited to participate in the focus group discussions. The research assistants and the researcher facilitated the focus group discussions together. Discussions focused on the negative and positive contribution of smallholder dairy to household natural, physical, social, financial and human capital; and also on the measures that can be taken to improve contribution of dairy farming towards livelihood.

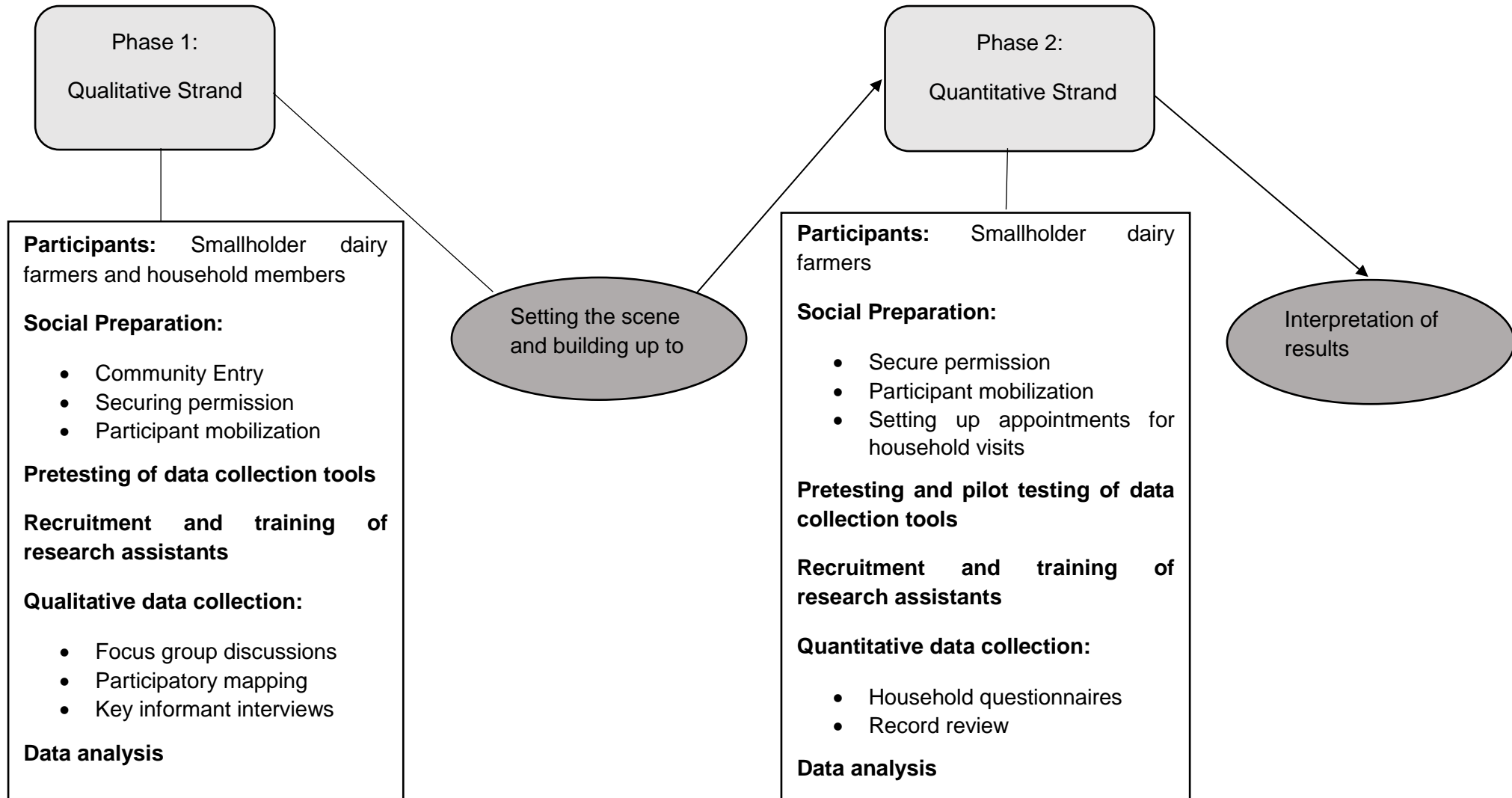


Figure 3.2: Research design of the study: Sequentially integrated mixed method design

### ***Recruitment of focus group discussion participants***

Participants were invited to take part in the focus group discussions through telephonic messages. Help was sought from the Nharira Dairy management committee secretary in communicating with the farmers. An invitation, in the form of a text message, was extended to the farmers to bring four representatives from their household. The four representatives being adult men and woman together with female and male youth. Four representatives were requested from each dairy farming household so as to get views from the four different social groups. Youth group comprised of individuals between the ages of 15 and 35 in accordance with the definition of youth in Zimbabwe (UNESCO, 2006; GOZ, 2013). However, due to other commitments, not all household were represented.

The participants met at Nharira dairy center as they are located closer to the place and is a usual meeting area for them. A total of 14 individuals participated in the focus group discussions and these constituted three groups comprised of four men, five women and five youth. The groups were constituted according to gender and age dimensions so as to capture different views.

### ***Procedure followed for focus group discussions***

Participants gathered at Nharira dairy centre to take part in the focus group discussion and participatory mapping exercise. The chairman of Nharira dairy, as the leader of the farmers, opened the meetings with welcoming remarks and introduced the research team to the participants. A follow up explanation of the purpose of the meeting and how the activities were to unroll was given. Ethical issues were also addressed during the meetings. The participants were informed about voluntary participation and also permission to take pictures and to record voices was sought.

The participants were then divided according to the social group they belong to. However, , since there was only one female youth, a decision was taken to merge her with the male youth. Within smaller groups, further explanation of the procedure was given together with the distribution of stationery and equipment. The participants were given the focus group discussion guide (See Appendix 9). The groups selected a note taker to write down the responses from the group. To complement the information captured, voice recorders were used to capture the discussions.

Data was analysed through thematic content analysis. Themes originated from the focus of the questions which were under discussion. These include the dairy farming routine, positive and negative contribution to livelihoods and challenges faced in dairy farming.

### 3.6.2 Participatory social mapping

Participatory social mapping is known to provide a connection between the people and the multifaceted environment which surrounds them (Nicholson, 2005). It allows participants to respond to research questions in a manner that relates to their lived experiences and environment. In this study, participatory social mapping was used to depict the meaning or contribution of smallholder farming to the livelihoods of the farmers as part of the exploratory phase one of the study.

Participatory social mapping has long been used as a visual qualitative research question interrogation method (Panek, 2015; Walker & Peters, 2001). Participatory mapping is the visual presentation of the perceptions of a group of people with regards to a phenomenon. The tools tell stories, bring out conversations, and show the way of living of the people drawing the maps. Mapping has been commonly used to depict the spatial distribution of various features within a locality. However, participatory social mapping introduced the visual presentation of mental processes shaped by local knowledge and experiences without necessarily including the geographic distribution of the features represented. Even though spatial distribution is sometimes not factored in, participatory social maps depict relationships, culture, history, trends and associations experienced by the people constructing it. Over the past years, participatory mapping has been widely used in different regions of the world in social research due to the richness of the data collected in this manner (Coberrrt, 2009). They complete their function regardless of the presence of spatial maps, which show the geographic distribution of various features across an area and are usually drawn to scale.

Participatory social maps contain metaphors which allow for the representation of culture, traditions and local history that cannot be easily represented by spatial maps (Walker & Peters, 2001). Developing and bringing out the understanding of the participatory social map is done in a participatory manner whereby shared knowledge is generated. These kinds of maps are important in decision-making, designing a strategy and the evaluation of programs. The process of developing maps allows for deliberation among the participants, with little restrictions on the way the map should be constructed. Participatory social mapping is more engaging and allows for innovation, particularly when working with semi-illiterate or illiterate participants. It gives participants the space to make meaningful contributions to the subject under discussion. This is an important factor in development related instances that promote community engagement as the process gives participants an opportunity to reflect on their thoughts, feelings, realities and experiences.

As their name suggests, these maps are constructed by a group of people working together. The maps work this way because they fall under a family of Participatory Learning and Action (PLA) methodologies, which entrust the process of appraisal and analysis to the people involved (Chambers, 2008). Participatory social mapping can be applied in various disciplines to understand diverse features of a community (Emmel, 2008). A community might gather around to come up with a map. In such studies, a single map is produced by a group of participants in a participatory process. Full analysis of the map is done on sight through discussing the futures represented by a map. However, further subgroup divisions can be formed to ensure various map versions on the same topic for the purpose of enriching the data. Consequently, further analysis of the maps will need to be done in order to amalgamate the data from all the maps.

According to Coberrt (2009), there is need to evaluate participatory maps to ensure that they represent the views of a community. Unlike other kinds of mapping, it is challenging to determine if the information displayed on a participatory social map is complete or accurate. This is because the information represented is not constant as it is in other forms of mapping: for example, in the case of participatory spatial mapping or seasonal mapping particular features occur at the same time or place. Participatory social mapping focuses on the views of the participants that cannot be labeled as incorrect or inaccurate.

### ***Materials used for participatory social mapping***

Successful social mapping is facilitated by the availability of appropriate resources for the process. There is no generic list of resources needed, but this study made use of basic and easily adaptable resources. The exercise was carried out at the Nharira Dairy Centre hall and under the shade outside. Stationery used included A1 flip charts, coloured markers, sticky tape, pens, pencils, participatory social mapping guide, a facilitator and a voice and video recorder. The participants were encouraged to use any other materials which they deemed necessary.

Participatory mapping processes require participants to be supplied with a lot of stationery to enable them room for innovation. If need be, the participants may be allowed to use other materials beyond the stationery availed by the research team. Such materials may include sticks, stones, leaves and papers. These materials usually elaborate the context and culture of the people drawing the map and make the maps lively.

The venue of mapping sometimes determines the resources needed. For example, if mapping is to be carried out in an open space or under a tree, a flipchart stand might be a necessity unlike when the exercise is being done in a hall with surfaces where the charts can be attached to the

wall. Additionally, the venue should be conducive for deliberations; that is, it should have enough space to accommodate all participants and also be blocked from external disruptive noises. The venue for this study was conducive as the farmers always hold their meetings there.

Planning for participatory mapping needs to take cognizance of the people participating and their context. According to Peck *et al.* (2015), context is vital because it gives a problem a meaning. Not much can be done accurately without understanding the operational context. Likewise, context is important in determining appropriate materials that work better with the people under given circumstances. The materials should be adapted to the needs of the participants and their capabilities. This is particularly important when considering the participatory mapping guide and literacy levels of the participants. The mapping guide should clearly outline the purpose and the activity to be done and should be in the language that participants are conversant with. Facilitators play a crucial role in clarifying the research question and the mapping process. They should also be well trained and have clear understanding of their role in the participatory mapping process. Facilitators minimised interference in group discussion so as to enhance active participation and interaction among the participants.

Equipment such as voice recorders and video camera should only be used after getting consent from the participants. Sometimes the participants may not feel very comfortable with being recorded whilst engaging in discussion. Clarification of the reason behind the recording usually helps to avert this challenge. Voice recording during participatory mapping processes is critical for complementing field notes and picking verbatim quotes when analyzing the maps.

### ***Procedure for participatory social mapping***

It is always important to have a clearly articulated set of guidelines on how to carry out the mapping procedure. Poorly framed guidelines may compromise the effectiveness of mapping exercises as participants will not be sure of what is required from them. Sometimes it is necessary to translate the guide into a local language for effective communication purposes, especially when dealing with participants who are not comfortably conversant in English. The guide gave a clear explanation on what was expected of the participants. The participants in this study were comfortable working with a participatory mapping guide which was written in English. The guide is attached as Appendix 7.

In the case of this study, participants were representatives of communal dairy farmer's households. The group comprised of both male and female adults and youth who were divided into mapping groups according to age and social class. Groups were made up of between four

and twelve participants depending on the number that turned up. Additionally, small groups were opted for to ensure an enabling environment for participation as large groups often harness the views of domineering characters whilst sidelining the opinions of the more introverted ones. Emmel (2008), shares the same sentiments that small homogenous groups produce better results in participatory mapping exercises. The process of engaging group participants was the same as the one used for focus group discussion.

In this study, three groups engaged in a participatory manner to produce three social maps that represent what dairy farming means to their livelihoods and the way they live. The participants had to decide on how their map would represent their view. Three facilitators handled the three groups and they worked with the groups to go through the instructions after which they stepped back to allow the discussions to progress freely. However, the facilitators would monitor the proceedings from time to time.

After drawing the maps, participants were given time to share their product with the rest of the group in a plenary session. During the presentations, interpretations of their map given by the group were recorded. Follow up questions were asked so as to get clarity on the map features.

### ***Data analysis***

Participatory social mapping has data analysis embedded in it, but such analysis is not comprehensive. Data analysis started when the participants give an annotation of their maps during a plenary session. In this study, the groups chose a rapporteur to explain the symbols and metaphors within their map during the presentations. The symbols and metaphors took various shapes and forms depending on the group's choices. The rapporteur explained the reasoning behind selected symbols, metaphors, size, color and shape, elaborating on the linkages embedded in the map.

This analysis is crucial to achieve better understanding of the data the social maps produced. It also helped to maintain the voice and understanding of the participants who developed the map. It is important when using participatory mapping that the interpretation of the maps not lose the meaning given by the people who produced them. Through presentation, the groups were able to further clarify and refine the views represented on the maps. The researcher also had the opportunity to ask follow-up questions for further clarity.

Efforts to bring out the shared understanding from the maps called for analysis of data produced. The second kind of analysis carried out by the researcher processed all the output of the mapping

process in order to come up with ways to give the results concrete meanings. Thematic content analysis was applied. The first step in the data analysis process was to thoroughly study all the maps produced one by one whilst noting down the themes that emerged. The maps were studied in conjunction with the respective field notes and discussion recordings, as field notes and discussion recordings act as guidelines for better understanding of map features (Coberrt, 2009). In addition, discussion recordings are richly loaded with experiences and perspectives, which contribute to better understanding of the maps produced. They are also important in pointing out the commonalities in the maps. Listening and reading through the notes a number of times ensured immersion into the data. Notes and recordings also ensured that the voice of the participants was not lost in the process. The themes identified surrounded the livelihood capitals, namely financial, physical, social, economic and human. This means that all the identified metaphors were classified under the themes as either positive or negative contributions. Identified themes were in line with the objectives and purpose of the exercise. Particular attention was given to the size, colour and shape of the features of the maps in relation to the explanation given. These usually depict the value elements embedded in the feature, showing their popularity.

After identifying the emerging themes, the identified features of the maps were jotted down according to the theme that they fell under. A table was drawn to make the tallying of the map features and their respective group easy. The table clearly outlined the themes that emerged from all the maps, cross tabulating them with the specific feature and the groups that identified them. After compiling a list of all the features, they were read through yet again in order to identify the need to merge the related ones. Tallies were calculated to give a picture on the frequency of the identified features.

After pulling out the map features, it was necessary to look at the maps again to check for any outstanding data not captured on the table. Additionally, relooking at the map enabled the researcher to identify other important aspects or relationships that could have been depicted on the map unconsciously. These can bring out other important aspects and relationships that might have been omitted during map development and presentations.

Whilst listening to the voice and video recording of the mapping proceedings, verbatim quotes were picked up in order to give a good representation of the emotions and passion behind the issue under discussion.

### **3.6.3 Farmer household visits and interviews**

The questionnaire was formulated from the results of the first phase (qualitative phase) of data collection and literature. Using a household questionnaire, quantitative data was collected to determine the socio-demographic features, common production practices, biotechnical and

economic performance characteristics of households involved in smallholder dairy farming. The questionnaire was composed of closed ended questions relating to the five livelihood capitals. The questionnaire was administered to 21 smallholder farmers participating in the Nharira dairy scheme to collect data on certain characteristics of farmers and changes in social, physical, human, natural and financial capital. The variable categories are shown in Table 3.1, and a specification of the actual variables is given in Chapter 4, 5 and 6.

The questionnaire was administered through face-to-face interviews with the farmers during household visits. Face-to-face interviews were carried out as they are known to have a better question response rate than telephonic methods. Face-to-face interviews enable building rapport and openness which encourages truthful response to the questions (Nandi & Platt, 2017). All 21 farmers' households were visited for data collection purposes. Farm visits and inspection were also carried out at the same time so as to collect more data on the characteristics and production practises of the farmers. Pictures were captured, with permission, as records of some of the practises which the farmers were involved in.

Data were captured in IBM SPSS Statistics 24 and various descriptive analyses were carried out to deduce the trend and patterns. Various livelihood capital indices were calculated for each household through transformation of multiple variables. Specific analytical methods used are detailed in Chapter 4, 5 and 6 in relation to the objective under focus.

#### **3.6.4 Record review**

Record review was carried out in order to complement the information provided by the farmers on milk production. Individual farmer records and records obtained from the Nharira dairy scheme offices were reviewed. Most of the individual farmers' records were not up to date, but they provided a picture on the milk production levels of the farmers. Information obtained from the records include monthly milk production levels, spoiled milk records, pay out for milk sold and loans obtained from the dairy scheme. A record review guide was used to serve as a guideline for the aspects to look out for in the records. Data were captured on IBM SPSS Statistics 24 as part of the data collected through questionnaires.

#### **3.6.5 GPS identification of smallholder dairy farming households**

Smallholder dairy farming household's locations were identified by use of a Garmin eTrex 10 GPS locator. Each smallholder dairy farming household's geographic position was captured during the second phase of the study, so as to get picture on distribution across villages and distance from

the Nharira and Bvumbura milk collection centre. The coordinates were captured onto the household questionnaire. The captured coordinates were then processed into a geographic/spatial map.

### **3.6 Validity and Reliability**

Considering that the current study utilised both quantitative and qualitative methods, it is imperative to discuss validity and reliability. According to Golafshani (2003), reliability is the repeatability or the ability to get the same results if the study is repeated; and validity is the credibility of the study determined through asserting that the data collection instrument measures what it is supposed to. In this current study, reliability was addressed in various ways. The pilot study carried out ensured that ambiguous and confusing questions were rephrased. During focus group discussions and participatory mapping, reliability was ensured through community entry activities which built trust between the participants and the researcher. Trust plays a role in ensuring credibility of the responses given by participants (Hansen & Greve, 2015). In addition, group participants were given time to present their results to the rest of the participants to ensure that the correct meaning was drawn from the participatory social maps and focus group discussion recording. In addition, Cronbach Alpha value was used to measure the reliability of the livelihood capital scores as measures of livelihood capital index with regards to dairy farming. Further clarity on this is given in Chapter 7.

For this current study, face validity was established through construction of data collection instruments informed by theoretical literature review. Secondly, the qualitative data collection phase contributed to understanding the study area specific components of measuring livelihood capitals.

### **3.7 Ethical Considerations**

Ethical clearance (certificate number SARDF/15/IRD/05/0610) was sought from the University of Venda Research Ethics Committee. Thereafter, permission to conduct the study was sought from the local leadership of the Nharira community and the Management Committee of the Dairy Centre. This was achieved through holding meetings with smallholder dairy farmers, the local dairy extension officer, and the Nharira Dairy Scheme Management Committee. These meetings helped to gain community entry and helped connect the researcher with the study participants

After securing permission to conduct the study, further explanations were given to the dairy farmers with the aim of clarifying the nature of the study and how the results will be used. This cleared the way towards securing informed consent of the farmers to participate in the study. A written consent form that explained the study focus to the smallholder dairy farmers, as well as



their obligations and rights (as attached in the appendix), was given to the participants. In order to ensure that participation is voluntary, all the data collection tools were accompanied by a written consent.

Objective	Research hypothesis	Questions/	Variables or Measurements	Data Sources	Data Collection Methods, Techniques and Tools
a) To determine the socio-demographic, production practices, biotechnical and economic performance characteristics of smallholder dairy farmers in the Nharira dairy scheme;	The socio-demographic, production, biotechnical and economic performance characteristics of households involved in dairy farming in the Nharira scheme are the same		<ul style="list-style-type: none"> <li>• Age of dairy farmer, gender, highest educational level, family size and composition</li> <li>• Number of cows, production system, feeding and feed management, sources of feeds</li> <li>• Cattle breeds, breeding systems used, feeding systems, disease control method</li> <li>• Participation in other agricultural production activities, income, earned from dairy, markets supplied, average milk production, quantities of milk used for household consumption, cost of feed</li> </ul>	<ul style="list-style-type: none"> <li>• 21 smallholder dairy farmers in Nharira Ward</li> <li>• Farmer household members</li> <li>• Dairy farmer records;</li> <li>• Nharira Dairy scheme chairperson, secretary and livestock extension officer</li> <li>• Household GPS coordinates</li> </ul>	<ul style="list-style-type: none"> <li>• Focus group discussion</li> <li>• Participatory social mapping</li> <li>• Key Informant interviews</li> <li>• Individual household Questionnaires</li> <li>• Record review</li> <li>• GPS locator and recording sheet</li> <li>• Voice recorder</li> <li>• Camera</li> </ul>
b) To identify the positive and negative contribution of smallholder dairy farming towards social, and human, capital within households in the Nharira dairy scheme	Participation in smallholder dairy farming has resulted in increased levels of household social, and human capitals		<ul style="list-style-type: none"> <li>• Collective action</li> <li>• Groups and networks</li> <li>• Trust and solidarity</li> <li>• Empowerment and political action</li> <li>• Education</li> <li>• Health and Wellness</li> <li>• Workforce and Employment</li> <li>• Enabling Environment</li> </ul>	<ul style="list-style-type: none"> <li>• 21 smallholder dairy farmers in Nharira Ward</li> <li>• Farmer household members</li> <li>• Dairy farmer records;</li> <li>• Nharira Dairy scheme chairperson, secretary and livestock extension officer</li> </ul>	<ul style="list-style-type: none"> <li>• Participatory social mapping</li> <li>• Focus group discussions</li> <li>• Individual household questionnaire</li> <li>• Key informant interview</li> </ul>
c) To identify the positive and negative contribution of smallholder dairy farming towards physical, natural and financial capital within households in the Nharira dairy scheme	Participation in smallholder dairy farming has resulted in increased levels of household physical, natural and financial capitals		<ul style="list-style-type: none"> <li>• Natural Resource stock</li> <li>• Natural Resource access</li> <li>• Productive equipment</li> <li>• Basic infrastructure</li> <li>• Income</li> <li>• Savings and Investment</li> <li>• Access to financial aid</li> </ul>	<ul style="list-style-type: none"> <li>• 21 smallholder dairy farmers in Nharira Ward</li> <li>• Farmer household members</li> <li>• Dairy farmer records;</li> <li>• Nharira Dairy scheme chairperson, secretary and livestock extension officer</li> </ul>	<ul style="list-style-type: none"> <li>• Individual household questionnaire</li> </ul>
d) To suggest relevant practical measures to improve rural livelihoods through smallholder dairy farming in the Nharira scheme	What measures can be taken to improve rural livelihoods through smallholder dairy farming?		<ul style="list-style-type: none"> <li>• Characteristics of the dairy farmers</li> <li>• Contribution of smallholder dairy farming to livelihood capitals</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Chapter 4,5 and 6 findings</li> </ul>	<ul style="list-style-type: none"> <li>• Summative evaluation</li> </ul>

**Table 3.2: Summary of Study Objectives, Hypothesis, Variables, Data Sources and Data Collection Methods**

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## CHAPTER 4: CHARACTERISATION OF SMALLHOLDER FARMERS IN NHARIRA DAIRY FARMING SCHEME

### 4.1 Abstract

Characteristics of smallholder dairy farmers differ from region to region. This is because there is no universally agreed upon definition of a smallholder dairy farmer. Therefore, the objective of this study was to characterize the smallholder dairy farmers in Nharira dairy scheme, Zimbabwe. In this study, characterization of smallholder farmers in Nharira Dairy is outlined based on production, socio-demographic, economic and biotechnical factors. Data were collected through focus group discussion and household surveys of 21 households. Narrative analysis and descriptive statistics were used to analyse the data. The results showed that daily dairy farming duties are taxing and limiting to the amount of time the farmer has for leisure. The majority of dairy farmers were elderly women as compared to men and young women. Youth participated as labourers at households but not as owners of the dairy enterprise. Farmers do not own large numbers of dairy breeds but supply milk from their beef and dairy and beef cross breeds. Availability of land for dairy farming was identified as the major challenge hindering growth in the industry. Based on the results of this investigation, the study recommends the establishment of programs to encourage youth to join the dairy scheme for sustainability and transition purposes.

**Key words:** Biotechnical factors, economic, dairy routine, production practice, socio-demographic

### 4.2 Introduction

Smallholder dairy farming is of significance in the provision of livelihood source and poverty alleviation strategy to rural households across the globe. Smallholder dairy farming increases household income through participation in milk market (Atuhaire *et al.*, 2014). According to FAO (2016), livestock rearing activities such as smallholder dairy farming increases household resilience, improve productivity and market participation. Milk also provides a nutritious source of food to the household. Milk production in Zimbabwe is characterized by large scale commercial and the small-scale farmer's sector (Kagoro & Chatiza, 2016). There are about 233 large-scale commercial dairy farmers in Zimbabwe coupled by 1743 smallholder farmers, who contribute to the national milk output (Kagoro & Chatiza, 2016). Smallholder dairy farmers contribute about 3% of the national milk output of about 51 million litres. This falls short of the national demand for milk and milk products by 129 million litres (Kagoro & Chatiza, 2016). As such, the country is still not self-sufficient with respect to the milk produced. This sufficient gap necessitates production by smallholder dairy farmers. Though there are numerous advantages of carrying out smallholder

dairy farming, it is faced with numerous challenges. Challenges faced differ accordingly from place to place and vary in intensity.

In Zimbabwe, the challenge of accessing milk markets was addressed by the establishment of small-scale dairy processing schemes. These schemes take the form of cooperatives that are owned and managed by the participating farmers. The farmers produce the milk individually and pool their produce for processing purposes. The milk is processed into various sizes of fresh milk, sour milk and yogurt and sold to nearby shops and schools. Profits and expenses are shared among the farmers. This ensures that the farmers always have a ready market for their milk and milk products.

Unlike countries such as India and Pakistan where significant amounts of milk are produced by buffalos (Deb *et al.*, 2016), most of the milk in Zimbabwe is produced from cattle. Different smallholder dairy farmers have characteristics that differ depending on the region in which they are found. The differing characteristics determine their output levels, viability, the extent to which they benefit or are disadvantaged by dairy and the government action to support the enterprise. Consequently, this study sought to determine the socio-demographic, production practices, biotechnical and economic features of smallholder dairy production within households involved in the Nharira dairy scheme so as to make recommendations for the enhancement of the enterprise.

Understanding the characteristics of the smallholder farmers helps to determine the sustainability of dairy enterprises as an agricultural practice, poverty eradication tool and a livelihood source (Chand *et al.*, 2014). A report generated by FAO (2016) outlines the roles that livestock production (which dairy farming is a part) can play in the achievement of the 17 Sustainable Development Goals (SDGs). However, in order to capitalise and build on such potential require clear knowledge on characteristics of the farmers, and the related practises which they carryout.

## **4.3 Materials and Methods**

### **4.3.1 Study site and participants**

The study was carried out in Nharira, with smallholder dairy farmers as discussed in Chapter 3. Representatives of smallholder dairy farming households took part in the focus groups. The smallholder farmers responded to the household questionnaire.

### **4.3.2 Data collection and analysis**

Data was collected through focus group discussions and household questionnaires. During focus group discussions, participants characterised the typical dairy related activities that were carried out on daily basis at households in relation to the responsible member of the household. Three social groups (adult male, adult female and youth group) responded to the interview guide. Data were processed using narrative analysis. Narrative analysis is a form of qualitative analysis in which the analyst focuses on how respondents impose order on the flow of experiences in their lives (Creswell, 2014). This aids in making sense of events and actions in which the participants have experienced. Furthermore, data on the distribution of smallholder dairy farmers across villages in Nharira were collected by means of a GPS coordinate locator and captured on the questionnaire as described in Chapter 3. The coordinates were used to construct a geographic map shown in Figure 4.2.

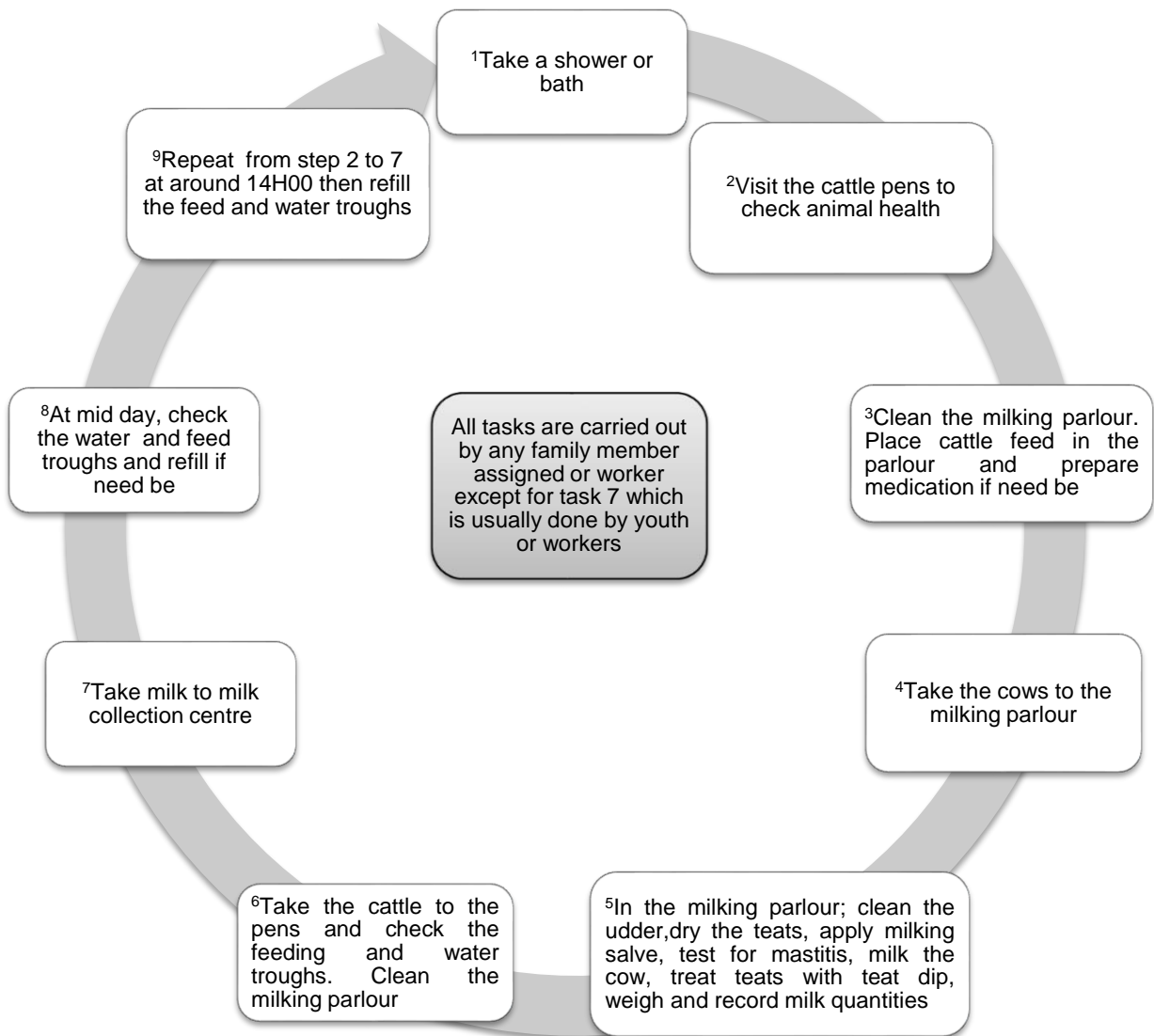
Household surveys were carried out to determine household-specific characteristics of the dairy farmers. The specific characteristics are shown in Table 4.1, 4.2 and 4.3 below. Data were collected from all the 21 smallholder farmers who were members of Nharira Dairy scheme. The small-scale commercial farmers were not included in this study because they have very different characteristics from the smallholder farmers. Data were collected through household visits and one on one interview. Descriptive statistics were generated using IBM SPSS Statistics 24 software.

## **4.4 Results**

### **4.4.1 Daily smallholder dairy farming routine**

The three groups representing dairy smallholder farming households gave almost the same account of the daily farming routine, which they follow. The accounts were analysed and merged to produce Figure 4.1, which shows the step-by-step dairy related tasks carried out daily.

All the participants highlighted the need for taking a bath before milking the cows as an essential hygienic practice that needs to be maintained all the time. This was mentioned as the first task carried out by a dairy farmer early in the morning around 5 am. A series of tasks then followed, as shown in Figure 4.1, as the day progresses. Of interest are animal health and hygienic practices that are observed throughout the daily dairy farming routine. These include checking cows on heat and testing for mastitis, which ensures that the milk collected is free from unwanted pathogens such as bacteria. Additionally, checking for animal health helps with early detection of diseases, which enables the implementation of control measures or practices in time.



**Figure 4.1: Flow chart showing step by step dairy-related tasks carried out by smallholder farmers in Nharira Dairy scheme**

Another health practice applied is cleaning of the parlour before and after milking so as to ensure that milking is done in a sanitary condition. This indicates the fact that the smallholder farmers consider health and hygienic practices seriously. Even though all the participants were mentioning these activities, the youth group was more articulate spelling out more information. They gave a more detailed account of the hygienic practices and disease precautionary measures, which were followed by households.

Only the youth group mentioned record keeping as part of the duties carried out. They indicated that weighing and recording of milk was done after every milking. According to youth group, record keeping is important in tracking progress and identifying areas that need improvement. This could be an indication that the youth were the ones usually assigned the task or the ones who actively carried out the task whenever they are available to do it. Other records kept by individual farmers included parturition date, calf weight, inoculation dates, milk payouts, quantities and cost of feeds. However, individual farmer record inspection revealed that most of the farmer records were not up to date.

There was clear indication that smallholder dairy farming involves a lot of hard work. One male participant highlighted the need to involve the whole family in dairy related activities during the discussions. He expressed it in the following manner,

*“Sepamba basa harisi remunhu mumwechete kana riri redairy. Nderekubatsiranwa kuti mai vachiita neuko, iwe uchiita nekoko, vana vachiitawo neuko ndokuti musimuke. Wega haungamborikwanise”. (Meaning: One person at a household cannot carry out all dairy farming chores alone. You cannot manage it. It is better if the wife, children and the husband help each other.)*

The need for the family to work together was further verified by the fact that activities that were carried out in the morning were repeated in the afternoon. This is because milking was done twice a day and as such, the farmer will be carrying out dairy related tasks throughout the whole day. The youth group further alluded that hay and silage preparation tasks are performed as additional tasks during the mid-rainy season (January to March), in preparation for the dry periods.

The participants, particularly youth argued that the mentioned duties were not exhaustive as other duties were not carried out every day but as need arises. Consequently, these duties were not included as part of daily routine. For example, if a disease is noted on an animal, the farmer needed to go and report to the livestock production extension officer or carry out the inoculation themselves. Sometimes differing challenges arise within the dairy enterprise (Hansen & Greve, 2015). Working through these challenges adds to the already long list of usual daily chores.

#### 4.4.2 Socio demographic characteristics

Results from the study (Table 4.1) show that there were more smallholder female farmers (61.3%) participating in Nharira dairy as compared to their male counterparts. All smallholder dairy farming households were headed by males except for four (19.0 %). Study results from Table 4.1 show that 71.4% of the participants were married, with none being recorded as single. This is understandable considering the fact that only two out of the 21 farmers were below the age of 35.

More than half of the communal farmers were above the age of 65 years (in Table 4.1), which is the retirement age. This concurs with the issue raised by the youth group during focus group discussion that old people remain within dairy farming thereby blocking the way for young people. Kagoro and Chatiza (2016) alluded to the fact that smallholder farmers in Zimbabwe run their enterprise with a weak succession plan regardless of the presence of youth at their households. This presents a threat to the future of smallholder dairy farming in the country.

More than half of the farmers (52.4%) had households with between four to seven people (Table 4.1). This is beneficial for the provision of farm labour from the household. Households of larger sizes can share the labour across the members making it easy for them to get through the chores.

Almost all the farmers (95.2 %) had at least some form of education except for one. Being literate is important in dairy production as there are a number of training activities that the farmers participate in. Additionally, dairy production involves carrying out some measurements such as calf weight, quantity of milk produced, quantity of vaccines administered to an animal and drenching against internal parasites. All these activities require some literacy. It is interesting to note that about 18 out of the 21 (85.7 %) farmers indicated farming as their primary employment. This is not alarming considering the fact that Zimbabwe is faced with high levels of unemployment (Bhebe & Mahapa, 2014). Dairy farming is acting as a buffer to the unemployment challenge. None of the farmers were formally employed elsewhere regardless of their highest education qualification. This could be related to the fact that most of the farmer have reached the retirement age. On average, smallholder farmers in Nharira Dairy had about 18 years of experience in dairy farming. Experience can positively impact on productivity as one would have mastered the art involved in the enterprise.

**Table 4.1: Distribution of respondents according to socio demographic characteristics**

<b>Parameter</b>	<b>Descriptors</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Gender of Farmer</b>	Male	8	38.1
	Female	13	61.3
<b>Gender of household head</b>	Female	4	19.0
	Male	17	81.0
<b>Age</b>	<= 35	2	9.5
	36 – 45	2	9.5
	46 – 55	2	9.5
	56 – 65	2	9.5
	>65	13	61.9
<b>Marital Status</b>	Divorced	1	4.8
	Widowed	5	23.8
	Married	15	71.4
<b>Education Level</b>	No Education	1	4.8
	A 'Level	2	9.5
	Tertiary	2	9.5
	Primary	7	33.3
	O' Level	9	42.9
<b>Employment status</b>	Pensioner	1	4.8
	Self employed	2	9.5
	Farmer	18	85.7
<b>Household size</b>	<3	5	23.8
	4 - 7	11	52.4
	8 - 10	3	14.3
	>10	2	9.5
<b>Years in dairy farming</b>	<b>Average</b>	<b>Maximum</b>	<b>Minimum</b>
	17.95	36	2

#### 4.4.3 Production, biotechnical and economic features of smallholder dairy farmers in Nharira

Farmers in the study area indicated that they followed the mixed crop and livestock production system. Under this system, they rear both dairy and beef cattle whilst producing field crops that include maize (*Zea mays*), peanuts (*Arachis hypogaea*), Bambara groundnuts (*Vigna subterranea*) and African horned cucumbers (*Cucumis metuliferus*). Cattle ownership per household ranged from four to 50 with an average of 15. The participants, however, had smaller stock when it comes to dedicated dairy cattle. Dairy cattle ownership ranged from zero to 12 with an average of 4 per household. The farmers kept a variety of dairy breeds but mainly a mixture of Mashona and dairy breeds such as Red Dane, Holstein, Freisland and Jersey. Only 5 (24 %) households had at least one dairy breed from the above-mentioned selection. Additionally, 24 % of the households did not own any dairy breed but purely relied on Mashona breed for milk to participate in the dairy scheme. Mashona breed is a Zimbabwean indigenous beef cattle breed that is hardy and well adapted to the harsh weather conditions.

Smallholder dairy farmers in Nharira owned land that range from one to 14 hectares with an average of 6.1 hectares. This was well above the national average of 3.0 hectares for smallholder farmers (Ngongoni *et al.*, 2006). Even though the farmers owned an average land size above the national average, it was still not enough for their growing cattle herd. The farmers indicated that they allocate an average of 2.84 and 1.88 hectares of land for grazing and pasture production, respectively. However, 66.67 % of the farmers highlighted that they produce pastures for their cattle. An average of 2.71 hectares was allocated for field crop production. The farmers however raised a need for more land for pastures for their animals as they have a relatively larger cattle herd than other farmers.

Most (86 %) of the smallholder dairy farmers in Nharira indicated that they give supplementary feeds to their cows whenever they deem necessary. Heifers also got the same treatment as the cows since they were expected to start contributing to milk production as early as possible. Bulls were often left to graze in open paddocks. Slightly more than half of the participants (61.9 %) indicated that they pen feed their animals. About 95 % of the participants indicated that they grow their own pasture and fodder to compliment the cattle feed from communal grazing land. Communal grazing was practiced by 81 % of the farmers in Nharira. This is not alarming since the farmers under study are communal. Dairy farming provides a loss averting pathway for the farmers in that in the event of a severe drought, poorly developed maize plants are converted to make silage for cattle feed. All the participants indicated that they were not involved in animal

tethering in accordance to the animal well-being procedures (Nalubwana *et al.*, 2014). Tethering strains animal health, which can result in low milk productivity and weight loss.

Study participants (61 %) indicated that they had once carried out artificial insemination. However, they reported that they were not so successful with it. Despite the fact that the farmers had at least once tried artificial insemination, 81 % still practiced natural service when breeding the dairy cattle. However, the farmers practiced selective breeding so as to ensure that the best bull services their cows. Only 4 (19 %) households indicated that they do not use natural service for their dairy cows and purely depend on artificial insemination.

Almost all the participants (95.2 %) indicated that they kept records for their dairy enterprises. However, upon inspection of the records, it was observed that they were not up to date and sometimes the records were improperly done. The farmers indicated that they have been trained on several times on record keeping and they have the knowledge on how to do it. The farmers revealed that they do not have up to date information because they find record keeping to be time-consuming. This might be the reason behind records which were not up to date. During focus group discussion, one of the female participants expressed that,

*“varimi vechikuru vane hutsotsi hwavainahwo, ruzivo anarwo asi haazoiti zvaakadzidza on the ground....kana farmer asati aziva kuti ari in business haana zvaanzvo.”*  
(Meaning: Old dairy farmers are imprudent in their dealings, they have the knowledge but do not apply it... If a farmer has not yet started viewing dairy farming as a business, he/she has not started doing anything).”

The dairy farmers who participated in the study produced different milk quantities per day from their dairy enterprises. In the year 2015, the farmer who harvested the least amount of milk throughout the year got 171L. This is in contrast to the 16 037L that the highest farmer harvested. This variance can be attributed to differences in their herd size and cattle management practices. Some of the more experienced farmers indicated that proper feeding of their cows regardless of breed results in high milk yields for a greater part of the lactation period. Most of the milk was collected from November to April during the rainy session when pastures for feeding the cows are readily available. The resource-constrained farmers indicated that they dry their cows when there were not enough pastures to support the health and milk production of their cows. This means that some of the farmers do not produce milk beyond this period, as there will be a high need for cattle feed supplements if substantial yields are to be collected. Consequently, some of the farmers had low milk yields per annum.

#### 4.4.4 Calf rearing practices

All farmers alluded that they leave the calf to suckle from the dam except one who bottle-feeds the calves. The calves were also individually fed *ad-lib* in pens. Half of the farmers practiced calf weighing at birth so as to enable monitoring of growth. All the participants indicated that they do not cull the male dairy calves but raised them either for beef, for draught power or breeding. About 71.4% of the respondents indicated that they kept the male calves for draught purposes whilst the remaining 23.8% indicated that they raised them as part of the beef herd. Not much attention was given to the calves raised for either purpose as they were left to graze with the rest of the cattle herd on the farm. This could be explained by the fact that the cost of rearing male dairy calves is high in comparison to their productivity such that commercial farmers usually opt to cull (Moran, Rearing Young Stock on Tropical Dairy Farms in Asia, 2012). However, with regards to smallholder farmers, male calves can be grown for other purposes beyond marketing. These purposes include a store of value, draught power, for cultural practices such as traditional marriages and appeasement. Proper care for the calves especially the females is important for the sustainability of the dairy enterprise as it results in herd expansion and improvement (Matondi *et al.*, 2014).

Smallholder farmers in Nharira dairy used a variety of parasite control measures as shown in Table 4.2. All the farmers alluded to the fact that they used hand spray at their households for external parasite control. It is interesting to note that the use of communal plunge dip ranked the second least used method. This is unusual considering that the communal tanks are located at about 2.66 km away from their households. Additionally, the communal dips were set up for the benefit of communal farmers who in this case are opting out of using them.

#### 4.4.5 Milk delivery

The farmers in the study area used various modes of transport to deliver milk from their farm gates to the processing centre. The most commonly used mode of transport for delivering milk to Nharira processing centre is bicycles (Table 4.1) used by 76.2 % of the farmers. This could be because bicycles are relatively cheaper compared to other modes of transport. Moreover, the farmers reported that there was a revolving loan facility for bicycles buying which was set up at the Nharira Dairy centre. This enabled farmers to get bicycles and paying for them over a number of months. Additionally, the distance which the farmers travelled for the delivery is about 4.62 km on average, which is slightly more for delivery on foot and not so economical to use a motor vehicle. This necessitates the use of a bicycle. Figure 4.2 illustrates the distribution of the smallholder farmers across villages in Nharira. The Figure illustrates that the smallholder farmers

were located within various villages which are clustered around Nharira milk collection centre. None of the smallholder farmers were located close to the Bvumbura milk collection centre. This was supported by the results explanations given by the chairperson of the dairy, that Bvumbura milk collection centre was designed for the small-scale commercial farmers. The figure also indicates that the smallholder farmers were distributed across various villages of Nharira. This observation can be taken advantage of when trying to encourage other farmers to take part in dairy farming. The already participating dairy farmers can be used as village advisers and resource person and consequently avert the challenge of shortage of livestock extension personnel in rural areas (Gustafson *et al.*, 2015). This observation is vital for rural development practise.

#### **4.4.6 Dairy infrastructure**

As per the milk handling health procedures, there are some stipulations on the kind of infrastructure that a producer should have on their enterprise. Consequently, all the farmers had milking sheds at their households that looked relatively the same. This is due to compliance with the regulations that stipulates the building materials to be used.

The farmers owned various dairy enterprise facilities. About 90% of the farmers had calf pens that separated the calf from the dam to avoid over milking. Cattle handling facilities were also a common feature at the smallholder dairy farming enterprise. These are important for restraining cattle safely when performing routine health and management procedures. The study revealed that 81% of the farmers owned the milk handling facilities and paddocks that they set up. Some of the farmers (76.2%) had paddocks dedicated for dairy cattle. This means that such farmers had separate dairy and beef cattle paddocks. This enables proper attention and care to be afforded to the dairy cattle. Other features that were present at most of the households were the hay shed and silage pit that are used for the preparation and storage of feeds. However, all the farmers hand milk their cows as they did not own milking machines.

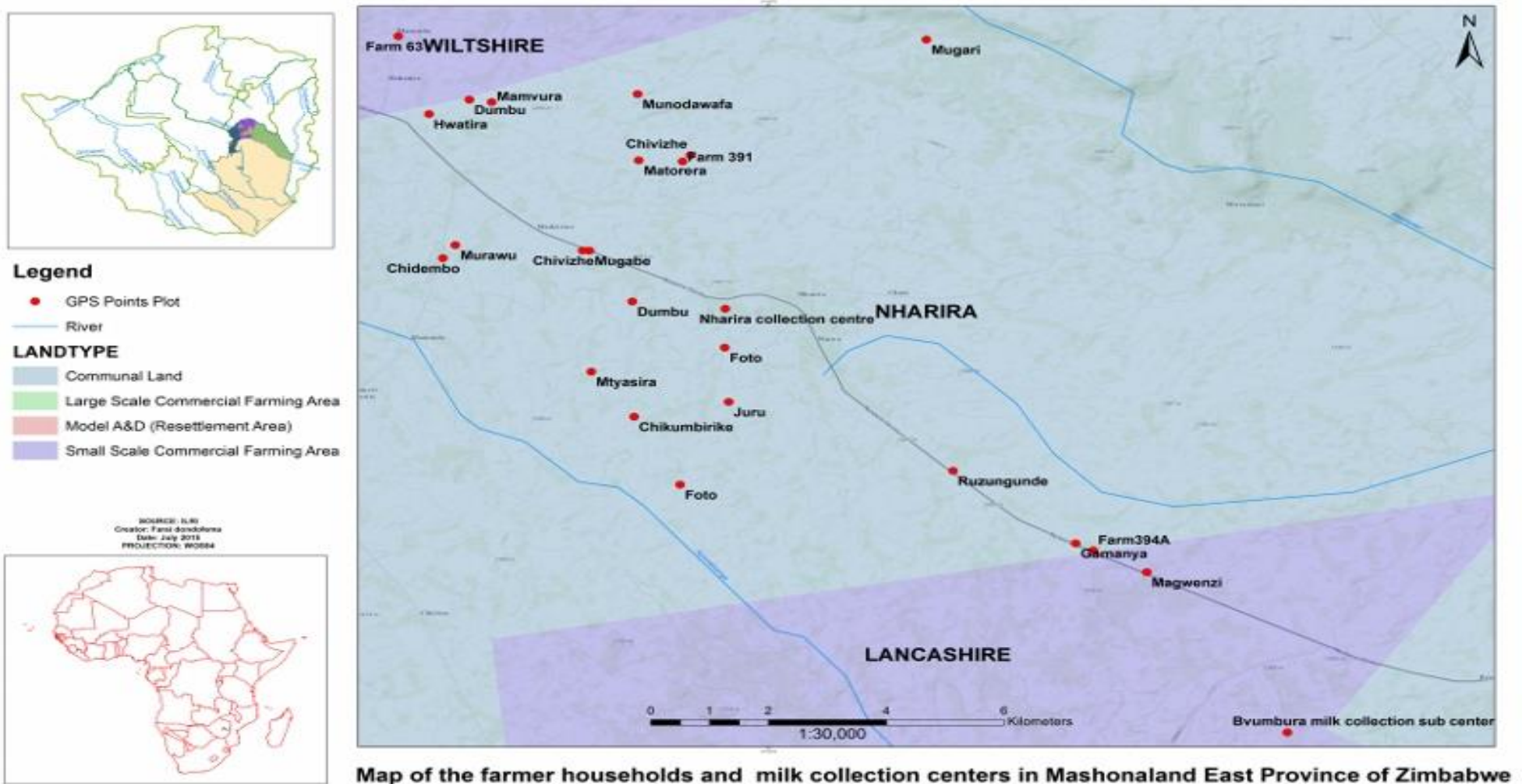


Figure 4.2: Map showing the distribution of smallholder dairy farmers across villages, in relation to Nharira milk collection centre, drawn from the GPS coordinates captured in field

**Table 4.2: Frequency of use of various parasite control methods among smallholder dairy farmers in Nharira**

External Parasite Control Method	Response (%)	
	Yes	No
Pour On	52.6	47.4
Communal plunge dip	66.7	33.3
Tick grease	81	19
Hand spray	100	0

**Table 4.3: Frequency of use of various milk transportation method**

<b>Mode of milk transportation</b>	<b>Proportion of farmers using the method (%)</b>
<b>Motor bike</b>	4.8
<b>Motor vehicle</b>	19
<b>Foot</b>	61.9
<b>Bicycle</b>	76.2

The presence of dairy enterprise resulted in the establishment of improved cattle management practices that contributed to the increased number of cattle herds owned by the farmers. These results are shown in Figure 4.2, 4.3 and 4.4; and presents the participatory mapping output from three groups of participants. Additionally, the improved cattle management practices contributed to the well-being of the other cattle which are not necessarily part of the dairy herd. Looking at the maps in Figure 4.2, 4.3 and 4.4, there are clearly visible distinctions across the three, though they were produced in response to the same question. The map produced by the youth had a more systemic approach, focusing on showing the linkages in the various processes that were being supported or affected by dairy farming at the household level. The map produced by the group of men was more attentive to household structures and how they have changed as a result of dairy farming. In contrast, the map drawn by women was relatively random looking at the aspects affected by dairy farming as independent features. Even though the participants took different angles to expressing their perceived contribution of dairy farming households, there are a number of similarities in the specific points that they were putting across. Furthermore, the different angles taken gave a broader perspective on the subject, showing the interests or areas of concern of the particular group.

#### **4.5 Discussion**

Results clearly show the high labour needs involved in dairy farming which necessitates the hiring of workers to help. It is interesting to note that there were no duties directly associated with any member of the household. Every member of the family could carry out the various chores associated with dairy farming. However, male youth and the farm workers mostly did milk delivery since they are physically fit and able to handle the heavy milk cans easily. The amount of work involved in dairy farming calls for well-coordinated labour division arrangements within a household if efficiency is to be achieved. This is in acknowledgment that there are other additional chores that are not necessarily carried out every day. These include cultivation of fodder and pastures and dipping the cattle.

Even though any member of the family could carry out dairy duties, women were more involved in dairy farming activities as compared to males. This might be due to the fact that small scale dairy farming is viewed as an enterprise which empowers women living in rural areas through providing opportunities for decision making, earning income and proactive production roles (Yasmin & Ikemoto, 2015a; b). This makes dairy an important enterprise when considering rural women economic empowerment projects.

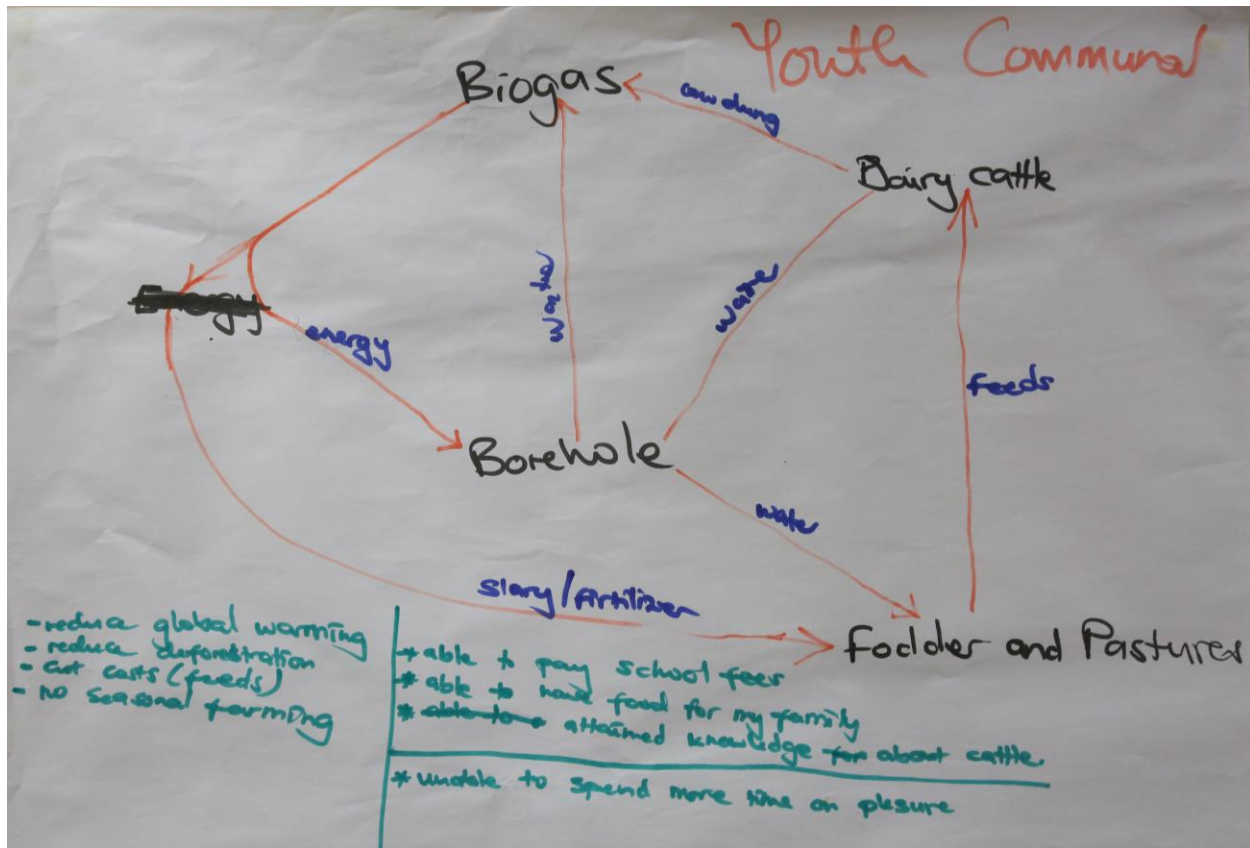


Figure 4.2 Participatory map on contribution of smallholder dairy to livelihoods drawn by youth group in Nharira

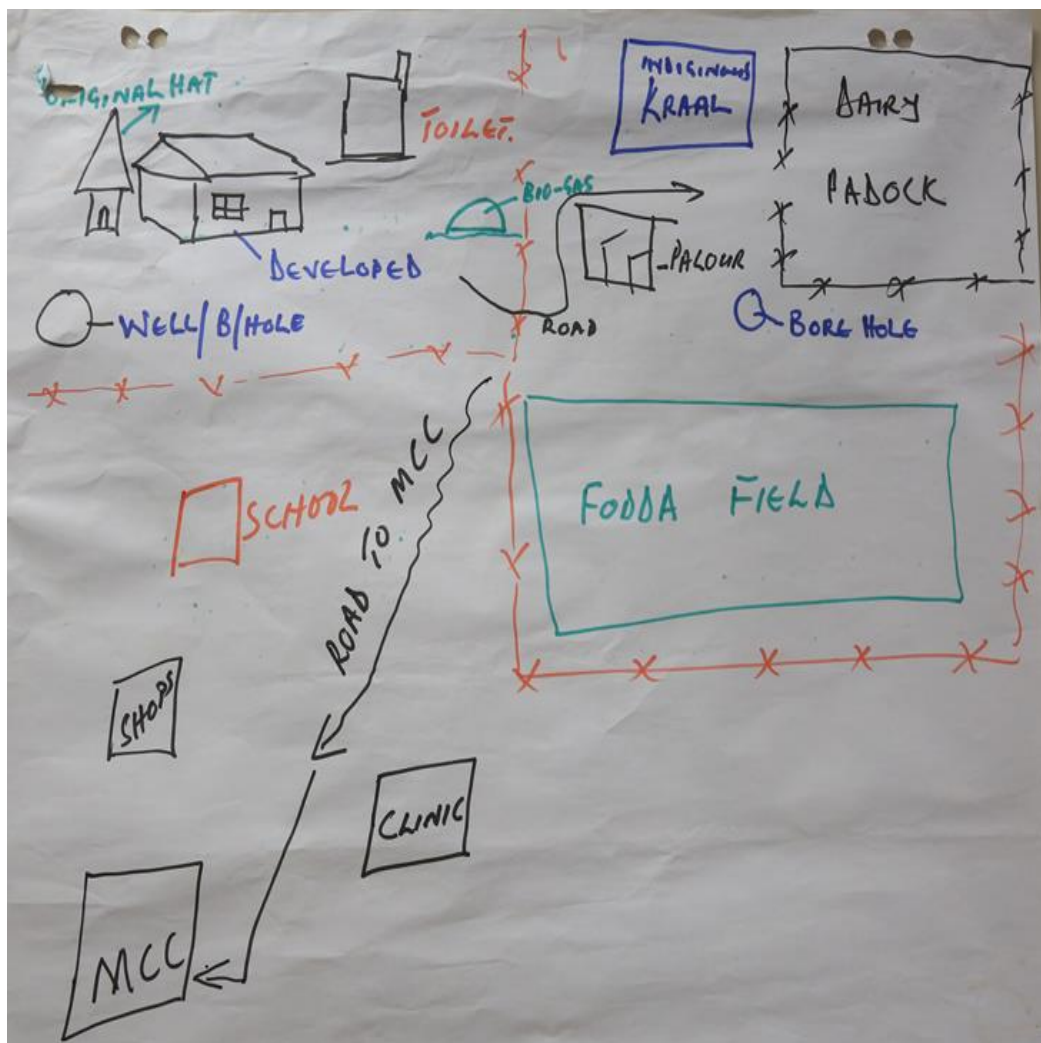


Figure 4.3 Participatory map on contribution of smallholder dairy to livelihoods drawn by men group in Nharira

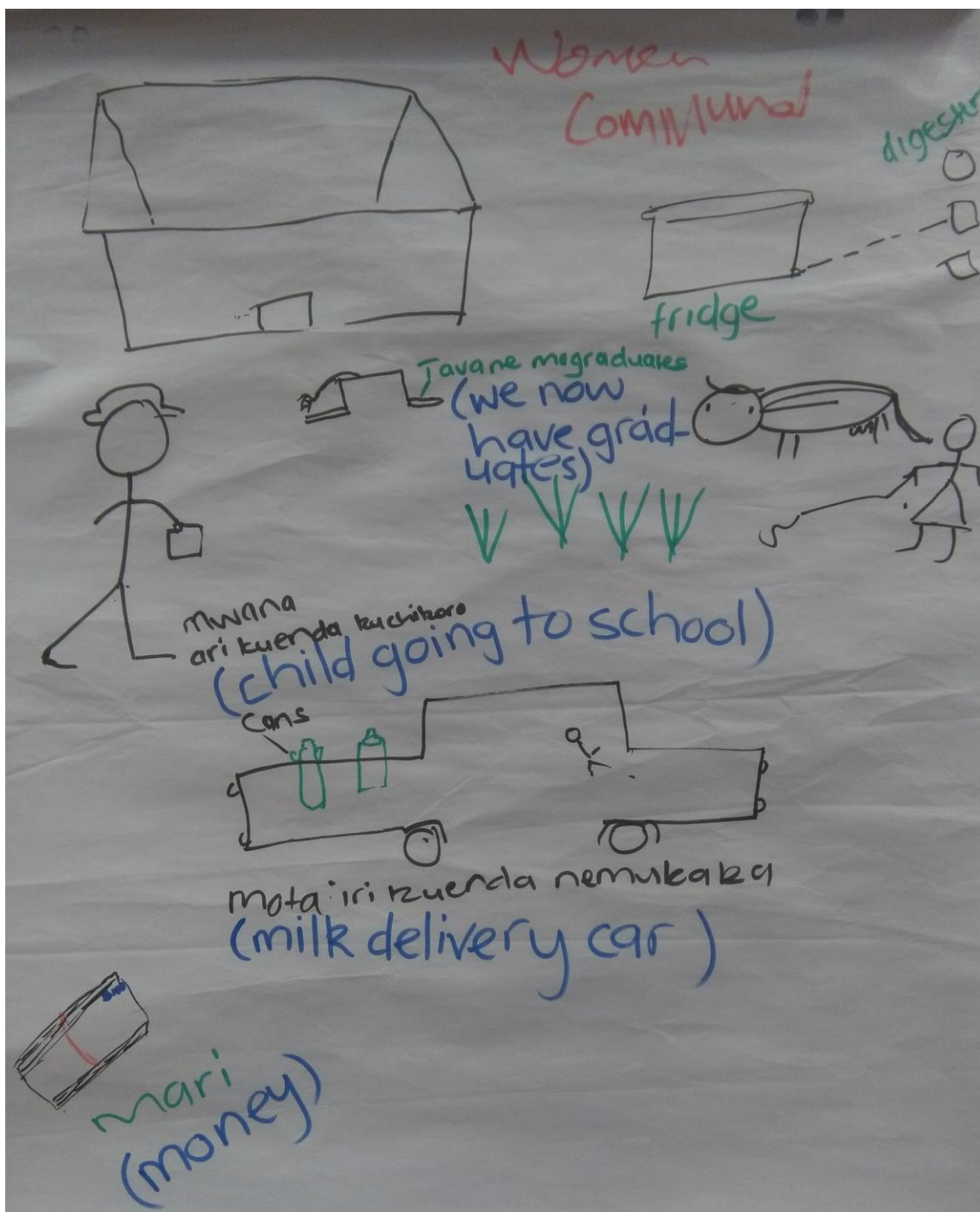


Figure 4.4 Participatory map on contribution of smallholder dairy to livelihoods drawn by women group in Nharira

Even though the phenomenon under study is dairy farming, it is important to understand the cattle ownership trend of the farmers. This is because a number of the farmers get their milk from the non-dairy breeds. This is an important factor to sustainability especially with farmers who cannot afford dedicated dairy breeds. Small-scale farmers, who are usually resource constrained, can benefit from dairy farming through the use of beef and draught cattle breeds. A number of the farmers highlighted that the Mashona breed can almost compete with dairy breeds if well fed and if good production practices are applied. Use of non-dairy breeds in the enterprise is vital for development planning. Though this resembles a lack of appropriate resource for dairy farming, such improvising enables the establishment of dairy schemes in most rural parts of the country since the farmers have traditionally kept cattle for subsistence purposes. However, for the smallholder farmers to make a colossal contribution to their livelihood asset portfolio through dairy farming, there is need to improve their dairy herd to pure breeds. Dairy breeds have high milk productivity that translates to higher income earning for the household regardless of their high acquisition costs (Matondi *et al.*, 2014).

The farmers indicated that they produced milk under the mixed crop livestock system. This concurs with other studies carried out on smallholder dairy farmers (Zvinorova *et al.*, 2013; Njarui *et al.*, 2016). This system allows for diversified income source and hedging of risk, particularly for resource-constrained producers. The risks are usually climatic, disease and parasite related. Mixed crop livestock system provides and enables the farmers to enhance household food portfolio and availability. However, this system presents challenges of overstocking given the limited land that is at the farmers' disposal (Kimenchu *et al.*, 2014). The two enterprises also compete for land particularly with the use of cultivated pastures for cattle feeding.

Results show that the farmers in the study area had all the necessary knowledge needed for dairy farming. They also had access to the extension office, which acts as an immediate source of information whenever the need arise. In the event of a disease outbreak, farmers can easily reach out to the extension officer and source advice on the steps to take. Access to extension services is vital for the sustainability of the dairy enterprise and keeping up to date with new technologies and practises (Asfaw, 2017). Though knowledge of dairy farming enterprise is important for improving productivity and sustainability, it does not benefit the farmer if there is no application. There is, however, evidence that application of the knowledge is still lagging behind among farmers in Nharira. Evidence to this is the poor dairy enterprise records that the farmers have. All the farmers acknowledged that they know how to do record keeping and have been trained

several times, but find it to be time consuming to do. According to Hansen and Greve (2015), knowledge is a source of advantage when applied accordingly. This calls for a need for advocacy for the implementation of acquired knowledge. Additionally, results show that youth easily identified record keeping as a daily dairy farming task as compared to the adult male and female groups which did not raise the matter. To this regards, youth show their relevance to dairy farming as they are comfortable around record keeping issues. It is, however, unfortunate that most of them are usually not available throughout the year to render help to their dairy farming households due to school commitments.

#### **4.6 Conclusions**

It can be concluded that the smallholder farming in Nharira is characterised as women run, high labour input, traditional cow based production, occasional supplementary feeding and organised marketing. The study also reveals that farmers keep the calves either male or female for other purposes beyond dairy production. There is, however, a need to improve youth participation in dairy activities as owners of the enterprises. In this chapter, the characteristics of the smallholder farmers in Nharira were uncovered. However, to get a comprehensive picture of the household livelihood characteristics of the smallholder farmer, there is need to unearth the household capabilities and asset. Thus, the following chapter focuses on the contribution of smallholder dairy farming to household human and social capital.

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## CHAPTER 5: CONTRIBUTION OF SMALLHOLDER DAIRY FARMING TO HUMAN AND SOCIAL CAPITAL OF THE PARTICIPATING HOUSEHOLDS IN NHARIRA DAIRY SCHEME, ZIMBABWE

### 5.1 Abstract

Smallholder dairy farming in Nharira is carried out as a livelihood strategy for the participating farmers. Human skills, knowledge, attitude, character and relationships, which constitute social and human capital are the major subjects covered in this chapter. Specifically, an attempt is made to build an understanding of the contribution of smallholder dairy farming as a livelihood strategy on household human and social capital portfolios. Data were collected through focus group discussions, participatory social mapping and household interviews. A census of 21 smallholder dairy farmers who were members of the Nharira dairy scheme was conducted. Qualitative data was transcribed and analysed using thematic content analysis. The International Business Machines Statistical Package for Social Sciences (IBM SPSS) 24 was used to conduct quantitative data analysis. Human and social capital indices were computed for each household using four component scores. Dairy farming was observed to be making a substantial positive contribution to households that ventured into it. Contribution included strengthening of groups and network, collective action and trust and solidarity, by indices of 0.70, 0.69 and 0.60 respectively. Human capital benefited from smallholder dairy farming through education (0.66 index value) and health and welfare (0.65 index value). The households in Nharira dairy benefitted slightly more in terms of social capital (0.59) as compared to human capital (0.48). Study findings revealed that smallholder dairy farming strengthens the livelihood capital portfolio of participating households. It can be concluded that smallholder dairy farming is a viable rural development solution to enhance household social and human capital.

**Key words:** Livelihood capital, strategy, participatory social mapping

### 5.2 Introduction

The Department for International Development (DfID) sustainable livelihood framework indicates that a household utilises the resources which will be at their disposal so as to generate outcomes. The livelihood capitals are utilised differently depending on the livelihood strategy chosen (Fang *et al.*, 2014). By following a certain livelihood strategy, a household can either strengthen or weaken some of its livelihood capitals. Moreover, following a specific livelihood option can result

in the conversion of one capital to the other. It is also important to maintain a balance across all the five livelihood capitals which are namely natural, physical, social, financial, and human (Levine, 2016). For the purpose of this chapter, focus is on how participation in smallholder dairy farming as a livelihood option affects human and social capital portfolio of households. Chapter 4 outlined the characteristics of the smallholder farmers including the human and social capital related factors.

Smallholder dairy farming is one of the livelihood options, which farmers in Nharira dairy scheme are involved in. Dairy farming is known to present a number of advantages to the practicing household (Moran & Chamberlain, 2017). Smallholder dairy farming has the potential of enhancing farmers' human capital through experience and various enterprise related training. The knowledge gained through the practice can also be applied to other economic opportunities. In addition, practising smallholder dairy farming requires social networks of information sharing and support to sustain the practise. Social networks formed through dairy farming can also play a significant role in other settings such as problem solving beyond dairy. There are various ways in which social capital is built up and utilised in practising dairy farming. However, there is also potential for neglecting some relationships due to taxing dairy farming routine (as alluded to in Chapter 4). This raises a need to understand the wholesome contribution of dairy farming, be it positive or negative towards the livelihood capitals of the farmers.

Smallholder farmers are known to be prone to risk and vulnerable to climatic and economic shocks (Fernandez *et al.*, 2016). Consequently, it is important to understand the livelihood options which benefit the household, resulting in a reduction in vulnerability. As such the objective of this chapter is to explore the contribution of small-scale dairy farming, as a livelihood option, to household human and social capital asset portfolio. Hence, the contribution of smallholder dairy farming to these two livelihood capitals is examined in this chapter.

Human capital is the knowledge, skills, experiences, labour and capabilities that an individual possesses and can be deployed for economic production (Etwire *et al.*, 2013; Kamaruddin & Samsudin, 2014). Possession of human capital enables an individual or household to pursue different livelihood strategies and options (Kumar *et al.*, 2016). Human capital, like any other capital, can either increase in value or decrease depending on a number of factors such as its application, environmental characteristics and available opportunities. When a human skill is applied, it is bound to improve with time and experience. Environmental characteristics such as

pollution can affect individual's well-being resulting in a reduction in human capital (Zivin & Niedell, 2013). Consequently, human capital can be developed or diminished depending on the various livelihood options which one is involved in. This capital can influence the acquisition, transformation and use of other livelihood capitals through human decision making. This makes human capital an important part of the livelihood capitals.

Related to the above mentioned is social capital. Human capital and social capital focus on the human attributes such as skills, capabilities, knowledge, attitude, networks and relationships (Schuller, 2001). Social capital is the networks, relationships, trust, collective identity and interactions which are beneficial for the production, enhancement and sustenance of a livelihood strategy (Flora & Flora, 2012). In contrast, social capital focuses on interpersonal relationships whilst human capital emphasizes on the individual skills and capabilities. Social capital as any other requires resources for its establishment and is subject to accumulation and erosion. However, its accumulation and erosion is not instantaneous but takes place over several number of years for relationships to be built and trust to be established (Grootaert & van Bastelaer, 2001; Schuller, 2001). Establishing social capital requires co-creation, whereby at least two people work together. This gives social capital properties of a public good which can be fully produced when the inherent positive externalities are fully internalised collectively. This usually makes optimum production challenging to reach as collective internalisation is not easily attained among groups of people.

Social capital is instrumental in four major ways which are acquisition of knowledge; diffusion of knowledge, technology or practices; application of acquired knowledge accordingly for problem solving, and for brokerage (Ahuja, 2000; Greve, 2010; Hansen & Greve, 2015). In a way, social capital plays a role in learning through participation or interaction in a community of practice. Hansen and Greve (2015), further explain that the community of practice generates a common set of understanding about certain thoughts, resources, actions and ideas which reside among human beings and are distributed socially. The aspect of learning embedded in social capital links with learning in human capital which focuses more on formal learning for knowledge acquisition. A study carried out in South Africa revealed that ownership of social capital endowments reduces the likelihood of rural household to be under poverty (Baiyegunhi, 2014). This is because the networks and linkages (social capital) work as buffers to vulnerabilities through shared problem solving and support system.

The relationship between social and human capital was first pulled out by Coleman (1988) who suggested that social capital is a resource for building up human capital. Social capital focuses on the relationships, networks and linkages that create a scene for the enhancement of human capital. Moreover, both social and human capital accumulate as due to repeated use. This is unlike other forms of capitals which waste away or are converted to other forms of capital with repeated use (Grootaert & van Bastelaer, 2001). Even though these two livelihood capitals have a direct linkage to human attributes, they are quite contrast.

Schuller (2001) provides a clear explanation of the distinction between the two forms of capitals according to focus, measurement, model, and outcome. The paper alludes to the fact that human capital has an individualistic focus, whilst social capital emphasises relationships. Additionally, human capital is mainly measured by educational level and years of schooling as compared to social capital which encompasses attitude, membership, and relationships. However, over the years, human capital has expanded to include individual wellbeing and health as a determinant of one's productivity (World Economic Forum (WEF), 2013). With human capital, the outcomes are linear in that an increase in the capital results in increased economic opportunities and income. In contrast, outcomes from social capital are circular and interactive (Schuller, 2001).

### **5.3 Materials and Methods**

#### **5.3.1 Study area**

The study was carried out in Nharira communal area of Zimbabwe. An exposé of the Nharira area is given in Chapter 3. Smallholder dairy farmers who were members of the Nharira dairy scheme and their household members were the study participants.

#### **5.3.2 Study participants, research methods and data collection**

As outlined in chapter 3, data were collected through household surveys. A census of the 21 smallholder dairy farmers was conducted through one on one interviews. This took place at the dairy farmers' households. In addition, data collected from participatory social mapping and focus group discussions were utilised. Representatives of dairy farming households participated in participatory mapping and focus group discussions. Groups were formed according to gender and age so as to unravel the assumed diverse opinions of each social grouping or cohort. Participants

constructed participatory social maps on the contribution of smallholder dairy farming to their livelihoods.

### 5.3.3 Data analysis

Human and social capital indices were calculated for each household. Variables included in the calculation of the indices were extracted from the household questionnaires. The indices were derived in order to understand the contribution of smallholder dairy farming to the particular household capital. All the respective variables collected were utilised in the construction of the human and the social capital indices in relation to dairy farming as long as there was variation across households (Table 5.1). Data reduction methods such as principal component analysis (PCA) or factor analysis could not be used due to the small (21) population size used for the study (Abeyasekera, 2003). Osborne and Costello (2004) agree with the notion that at least 100 observations should be made or a ratio of two observations per number of variable used. The index is an indicator of the specific capital status as a result of dairy farming, whilst holding all the other factors constant. As such, variables considered were related to dairy farming.

In this study, mixed method approach was applied to determine the livelihood capitals of the household. In establishing social capital, the insights from the paper by Jones and Woolcock (2007) were used. This classifies social capital under six dimensions which can be assessed by means of both qualitative and quantitative data. These dimensions are groups and networks, trust and solidarity, collective action and cooperation, social cohesion and inclusion; information and communication; and empowerment and political action. However, for the purpose of this study, four dimensions were used as the other two perfectly fell into other dimensions. The variables used to measure and capture each component are described below:

*Groups and networks:* This component was measured by determining the various support bases which the farmers relied on. These included the non-governmental organisations (NGOs), community members, research organisations or institutes and government. Study participants indicated if they had ever received a form of dairy related aid or training offered by various stakeholders. In addition, this component of social capital was measured by determining the farmer's membership and participation in various dairy related associations such as Zimbabwe Dairy Farmers Association (ZDFA). In a way, this dimension also encompassed some aspects of

information and communication particularly with regards to dairy focused training programs offered by various institutions.

*Trust and solidarity:* This component was determined by whether the farmers were satisfied by the support which they received from various entities such as government departments and NGOs. In addition, the number of individuals whom the dairy farmers relied on for advice was used.

*Collective action and cooperation:* This component was measured by determining if the farmers received and gave dairy related advice to others, if they borrowed or lend money to others if they offered or received help from other farmers and their contribution towards membership at Nharira dairy. In addition, the component was also measured by determining if the farmer had been caught up in conflicts with neighbours in relation to grazing land, increased number of houseflies and bad odours from dairy enterprise and labour networks. This component also had social cohesion and inclusion embedded in it.

*Empowerment:* This component of social capital as a result of dairy farming was measured by determining if a farmer had served as a committee member of the dairy association.

#### **5.3.4 Formulation of the social capital index**

The social household capital index was computed using four composite components adopted from Jones and Woolcock (2007) and Baiyegunhi (2014). Data were computed using SPSS version 24.0. Indicators were calculated for each household with a value between zero and one. The following equation was utilised:

$$SC = \frac{\sum(a; b; c; d)}{4}$$

Where:  $a$  = Groups and networks component

$b$  = Trust and solidarity component

$c$  = Collective action and cooperation component

$d$  = Empowerment component

Equal weighting was applied to the components when constructing the aggregate social capital index in this study. Equal weighting method used was adopted from Hahn *et al.* (2009), Su and

Shang (2012) and Xu *et al.* (2015), in analysing livelihood assets and strategies in this study. This method was deemed as the most appropriate for this study because it provides a neutral weighting option. Sullivan *et al.* (2009), cement this argument through their observation that assigning weights involves an inherent subjectivity in the process. Each component was formulated from the aggregation of various indicator variables which were in the questionnaire. The questions were focusing on the contribution of dairy farming to livelihood capital of households. For each of the five components, the variables used were mainly dichotomous with a “1 = Yes and 0 = No” response. For variables with a negative connotation, for example, “have you ever been involved in grazing land related disputes”, the response provided a negative contribution to the component. Thus, they were deducted. However, a few of the variables used were either continuous or categorical. Examples of categorical variables include satisfaction with support from government and NGOs. Examples of continuous variable include number of continuous variables include number of dairy related meeting attended per year and number of people farmer relies on for dairy-related advice. A detailed outline of the variables used is shown Table 5.1. Categorical and continuous variables were standardised in order to fit better as an element of the components. The following formula was used for standardization:

$$y = \frac{x_i - x_{min}}{x_{max} - x_{min}}$$

Where:  $y$  = *standardised variable*  
 $x_i$  = *the actual observed value*  
 $x_{min}$  = *the minimum observed value*  
 $x_{max}$  = *the maximum observed value*

For continuous and categorical variables which had a negative connotation or with higher values assigned to negative response, a reverse standardisation equation was used. An example of such a case is the response to the question, “how often do you participate in dairy related meetings?” with the response 1 = always, 2 = sometimes and 3 = never. The following equation was used:

$$y = \frac{x_{max} - x_i}{x_{max} - x_{min}}$$

The aggregate component value was calculated using the following formula:

$$a = \frac{\sum_{i=1}^n y_i}{n}$$

Where:  $y_i$  = standardised variables

$n$  = number of variables included in the construction of the component

Information from several variables is captured into a composite value through an index (Abeyasekera, 2003). An index is a value that captures the aggregate scores of a livelihood capital dimension.

### 5.3.5 Formulation of the human capital index

In assessing the household human capital levels, principles from the WEF (2013) human capital report were adopted. This classified human capital under four sub-categories which are education, health and wellness, workforce and employment and enabling environment. Even though these were applied at a macro level, the principles were adopted and assimilated with adjustments for micro level purposes. Table 4.1 details the variables used for each specific component. Furthermore, the variables used to measure the categories are explained as follows:

*Education:* This was measured by standardising educational attainment of the farmer, household member attendance of master farmer's training workshop and any dairy related training course.

*Health and wellness:* This was measured by a number of variables including if household experiences longer working hours and lacks leisure time due to dairy farming. These reduced the value of the health and wellness score as they contribute negatively to the human capital index. One of the positive variables included is increased demand for labour. This was viewed as positive in that it resulted in the creation of on-farm employment and thus enhancing human capital. Other positive variables included the ability of the household to buy nutritious food; clothing and protective wear using proceeds from dairy farming. Health and wellness score also included if the household had any children falling sick due to nutrition related disease after their commencement of practising dairy farming. Variables such as member falling sick and not affording to seek medical attention, and household members falling sick as a result of dairy farming were not included due to lack of variation. All the households indicated that they did not have such experiences.

*Workforce and employment:* This score was measured by the number of household members who were above the age of 15. This was considered to be the age at which one can make

meaningful contribution to dairy farming activities. In addition, the number of household members who provide labour for dairy farming and household member who are now employed as a result of dairy farming were also considered as variables. Moreover, the average monthly amount spent on paying for hired labour was included as a variable to indicate the investment in human capital which the household is involved in.

*Enabling environment:* This score focused on the conditions which are created as a result of dairy farming which either enhances or reduces human capital of the household. This was measured by distance from the household to the major road, primary and secondary schools. The closer the schools, the easier it is for the children to attend. Major road links the household members with workplaces and other training facilities which enhance human capital. The score also encompassed whether a household has accommodation space for the workers and if it was constructed due to the availability of funds from dairy farming. Farm workers cottages provide a conducive environment in which workers can stay and operate in. The score includes the number of household members who relied on income from dairy farming for primary school and secondary school fees payment. The variable which ascertained whether any member of the household left school due to dairy farming was left out since all the farmers did not have such an experience.

Human capital index was computed as an aggregate index of the above mentioned four factors. Equal weighting was applied to all the four components of the index. The same method applied for social capital was used in constructing the scores of each component. The formula below was used for calculating human capital index for smallholder dairy farmers in Nharira:

$$HC = \frac{\sum(e, f, g, h)}{4}$$

Where: *HC* = human capital

*e* = education component score

*f* = enabling environment component score

*g* = workforce and employment component score

*h* = health and wellness component score

**Table 5.1: Variables used in computing social and human capital indices**

<b>Capital Index Component</b>	<b>Variable Used</b>
<b>Social Capital</b>	
<b>Trust and solidarity</b>	Satisfies with support from; Government, NGOs, Community members, Research institutes, Extension office, Number of people relied on for dairy related advice
<b>Collective action and cooperation</b>	Give advice to other farmers, Receive advice from other farmers, Ever borrowed money from SACCO, Lend money to neighbours, borrowed money from other dairy farmers, Easy access to dairy related help, Give help to other farmers, Involvement in grazing conflicts, Involvement in labour related conflicts, Involvement in houseflies related conflict, involvement in other dairy related conflict, Up to date with membership subscription
<b>Groups and networks</b>	Ever receive support from; Government, NGOs, Community members, Research institutes, Extension office, Frequency of attending dairy related meetings, number of dairy events attended in previous year, membership in dairy associations, membership in SACCO, Member of labour network, Exposure to AI, Benefited from revolving fund, Cattle inputs scheme, Pass the heifer scheme, Received training on; Feed improvement, Feed formulation, Record Keeping, Dairy related research, Registered member of Nharira dairy
<b>Empowerment</b>	Member of Nharira dairy scheme management committee, member of any other dairy related management committee,
<b>Human Capital</b>	
<b>Education</b>	Highest education level of household head, Any household member received master farmer training, Short course training
<b>Enabling environment</b>	Distance to nearest; Primary school, Secondary school, Major road, Availability of workers quarters at household, Quarters build with funds from dairy enterprise, Ever paid school fees for children at Primary, Secondary and Tertiary level
<b>Workforce and employment</b>	Number of household member involved in Dairy, Number of Household members above the age of 15, Household member occupying a dairy related job, Cost of dairy related labour paid in the previous year
<b>Health and wellness</b>	Increased demand for labour, experience long working hours, lack leisure time, Member ever diagnosed of a nutrition-related disease, Household afford nutritious food and Clothing

## 5.4 Results and Discussion

This section presents the findings of the current study on the contribution of smallholder dairy farming towards human and social capital portfolio of participating households. Results from the quantitative and qualitative phase are presented and discussed.

### 5.4.1 Contribution of smallholder dairy farming to the household's social capital portfolio

An overall positive mean (0.59) social capital index was obtained for the small-scale dairy farmers in Nharira communal area (Table 5.2). None of the participating households recorded a zero score. Some households (48 %) were scored zero for the empowerment components (Figure 5.1). The distribution of households according to the social capital index and components is depicted in Figure 5.1. Components of social capital were observed to be moving along with each other, meaning that households which scored well in one of the components also did well in the rest of them, and vice versa. This means that in whatever the shape of the dairy farming enterprise at a household in Nharira, practising dairy farming enhanced the social capital of the household. This implies that practising dairy farming in Nharira contributes to the strengthening of social capital. Galey and Kaoru (2016); and Woolcock and Narayan (2000), agrees that organised dairy farming enhances the internal bond and external network of the participating households. Even though social capital is utilised during dairy farming, more is generated in the process as farmers join new networks and friendships. Dairy farming provided platform and spaces for the building of social capital for the participating household. The smallholder nature of the dairy farmers has potential to activate reciprocal interactions which strengthen social capital (Svendsen & Svendsen, 2000). Strengthening of social capital is important for carrying out tasks which cannot be achieved individually, especially for households living in rural areas and in poverty (Galey & Kaoru, 2016). Stable social capital improves the livelihood status of a household through acting as a facilitator of the productive environment and as a route to human development (Crowley & Green, 2016). This helps increasing income and lowering transaction costs.

Considering the various dimensions, the farmers experienced a strengthening of the groups and networks dimension of social capital. Table 5.1 indicates that the farmers had a mean score of 0.70 for groups and networks. This is because dairy farming exposed the farmer to a number of groups and social networks which provide support for the enterprise. These groups are however important because, through such interactions, more benefits are derived beyond issues related

to dairy farming. Friendship and relationships are built through such interactions and these provide a safety net for the farmers in the event that they are exposed to vulnerability (Tirivayi *et al.*, 2016). During focus group discussions, participants indicated that they interact with dairy farmers from all over the country during workshops and field days. Such interactions enabled them to share dairy related ideas and knowledge. They mentioned that in the same way, they managed to meet people from Botswana, Zambia and Malawi through dairy farming. Additionally, they raised the point that farmers who are members of the dairy relate more to each other as they share similar challenges and conditions. This has made them friends and enables them to help each other in times of crisis. One of the youth participants indicated that,

*“dairy rakanakira kuti unowana shamwari dzine muono wakafanana newako other than kuti uve uriwega. Kurima uri one kwakaoma panekurima nevamwe”* (Meaning: *Dairy farming ensures that you get friends who see things the way you do rather than being alone.*).

The above results imply that the farmers had more people they rely on to get financial advice and material help in times of need. The score was formulated from a series of variables which include participation in knowledge sharing activities on different dairy related aspects. This highlights the creation of a community of learning whereby farmers exchange knowledge with others (Hansen & Greve, 2015). This is important for the sustainability of dairy production in Nharira as there will be knowledge banks which are readily available and accessible to the farmers when necessary.

It is shown in Table 5.2 that smallholder dairy farmers in Nharira were benefiting through strengthening of the collective action dimension of social capital. This is because the dairy farming scheme brings different farmers together and enables them to chart the course of action, make decisions and plan together for the success of the scheme. Smallholder dairy farming in Nharira availed opportunities for the farmers to act collectively through the payment of subscriptions for being a member of the scheme, giving responsibilities to all farmers through the constitution governing the scheme and through organising various events as alluded to in Chapter 4. Such activities enhanced collective action by means of making it a practise for the farmers to act collectively. This is supported by the practise of collective action generated through dairy farming activities which resulted in the birth of a village bank namely Savings and Credit Cooperative Organisation (SACCO). More than three quarters (76.2%) of the respondents acknowledged strongly attributed the existence of SACCO to dairy farming in Nharira. Besides providing an opportunity for the farmers to meet and strengthen their relationships, SACCO provided an

important banking and saving institution especially in the face of less trust in formal banking avenues in the country.

Regardless of the overall high positive score for collective action, it is important to highlight the negative contribution of which lowered the score. Data used to construct the collective action score reveals that about 52.38 % of the farmers acknowledged that they have been involved in grazing land conflicts while 28.57 % and 19.05 % have been involved in labour network and other dairy related conflicts respectively, with their neighbours. This is a negative contribution of dairy farming to collective action.

Contribution of dairy farming to empowerment and political action score of the smallholder dairy farmers in Nharira was relatively low in comparison with other dimensions of social capital (0.38) coupled with a large standard deviation. This is because the score was formulated from one variable due to little influence or interaction which dairy farming has over empowerment and political action. However, beyond the score, it can be argued that dairy farming empowers women in earning some income and contribute to household financial status. Evidence to this is that there were more women farmers than men in Nharira as outlined in Chapter 4. On the contrary, the results were aligned to the findings from focus groups discussion where the participants highlighted that they did not involve anything related to politics into the Dairy scheme. This was to ensure that they do not lose control of the dairy scheme or get disappointed due to political meddling. Sudipta and Ritu (2009), support this notion by suggesting that rural community projects often underachieve under political intervention.

Households practising dairy farming in Nharira had a trust and solidarity score of 0.60 (as shown in Table 5.2). This score in contrast to a nationwide problem where generally people do not trust each other due to economic distress. Economic hardship causes people to treat each other with distrust as a result of corruption (King-Casas *et al.*, 2005; Rothstein & Uslaner, 2005). Corruption is one of the indicators of distrust and informality in the economy (OECD, 2014). In addition, people will suspect that the next person wants to benefit freely from the efforts of others due to lack of trust. With regards to different organisations, it is even more difficult for them to be trusted by local communities as there is always the suspicion that they will be using the farmers to achieve their own objectives. The trust and solidarity score for this study, however, might be an indication of the strong social fabric which is embedded in rural households and communities (Belgrave & Allison, 2010). This collective efficacy is established on principles of trust and solidarity.

The participants did not give many indicators of social capital through participatory social mapping. Maps produced are shown in Figure 4.2, 4.3, 4.4, in Chapter 4. Map drawn by the youth did not make any reference to social capital (Figure 4.2). However, the shop drawn by men can represent meeting place where the community members convene and chat during their leisure time (Figure 4.3). Women and men groups also showed the milk collection center on their map, which they explained as a meeting place, particularly for farmers (Figure 4.4). The place gives a platform for idea sharing and serves as a social capital infrastructure.

Nevertheless, the women depicted a dairy cow being struck with a whip by another person on their map. During presentations, they interpreted this as the agony which their cattle go through in the hands of their non-dairy farming neighbours. They highlighted that non-dairy farmers are jealous of dairy farmers because of the benefits they get from milk production and the fast growing dairy size. One participant of the women group expressed this plight as follows,

*“Vavakidzani zvemombe dzakawanda havazvide. Ini ndakarambirwa dzoro. N dofudza ndega....Mombe dzevamwe dzakadya ndisipo zvikanzi iri dzimba nderemombe yedairy, hakuna mombe ine dzimba nendoove yakakura kudai kunze kweyedairy” (Meaning: Neighbours do not like it if you have a lot of cattle. Neighbors no longer involve me in cattle herding turns. I herd my own cattle alone..... Someone’s cattle once grazed on a neighbor’s field and when they saw the hoof print, they said only a dairy cow can have such a huge hoof print and dung.)*

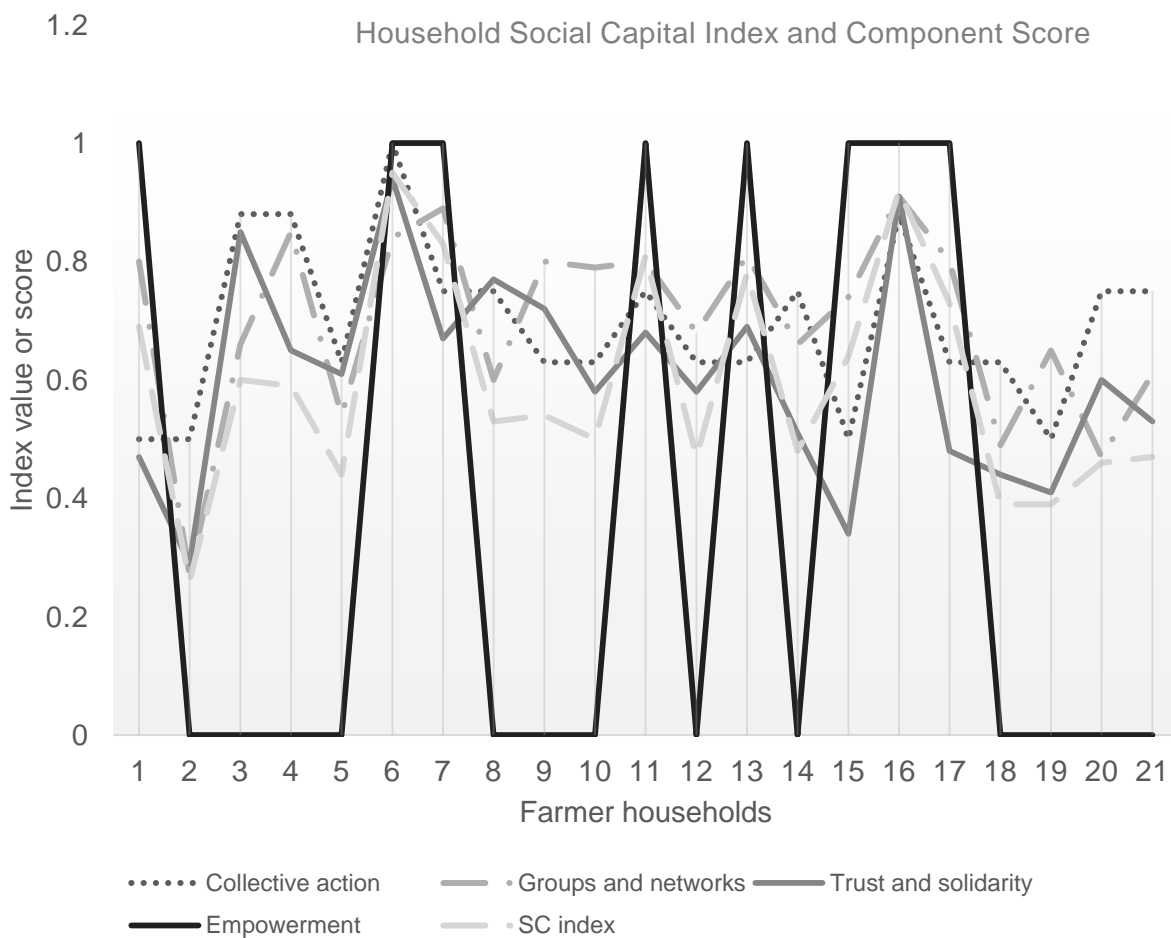
Such an expression highlights the plight smallholder dairy farmers. This is a negative contribution of dairy farming to social capital of the household as conflicts affect the network of the farmers and their neighbors.

#### **5.4.2 Contribution of smallholder dairy farming to household human capital portfolio**

The mean human capital (HC) index of households of farmers participating in smallholder dairy farming was 0.48 (Table 5.3), with a range of 0.38 - 0.62. This showed that all the farmers benefitted in terms of strengthening of human capital from dairy farming activities. Observed mean human capital index for the farmers is lower than the one observed for social capital (0.59). Consequently, it is clear that smallholder dairy farming contributes more positively to social capital as compared to human capital. The observed mean human capital index due to smallholder dairy farming was slightly below the 2015 country average of 0.509 (UNDP, 2015).

**Table 5.2: Descriptive statistics for Social Capital Index and its dimension across households participating in Nharira dairy farming scheme (N=21)**

<b>Indices</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Empowerment and political action	0.38	0.498	0.00	1.00
Trust and solidarity	0.60	0.175	0.29	0.94
Collective action	0.69	0.140	0.50	1.00
Groups and networks	0.70	0.159	0.27	0.91
SC index	0.59	0.186	0.26	0.95



**Figure 5.1: Distribution of household according to Social Capital index and component score**

The score was, however, encouraging as it was recorded for households in rural areas which are often viewed as resource constraint and living in poverty. This indicates that dairy farming is contributing positively to household's human capital for the practising farmers in Nharira.

The mean score for the education component was 0.66 with a standard deviation of 0.20 (Table 5.3). This showed that dairy farming benefits the human capital of participating household through enhancing education. This score measured the extent to which smallholder dairy farmers are benefiting in relation to education. The education component scored the highest component value for human capital. Dairy farming practices involved continuous training programs which address various dairy related aspects. Some of these programmes are certified and this makes a positive contribution to the human capital portfolio of the household as a certified master farmer can use that certificate to get employment somewhere else beyond the household farm. The master farmer training was provided for by the local extension officers. This result is important especially considering that the percentage of people who acquire education is higher in urban areas than in rural areas of Zimbabwe (ZimStat, 2014). Smallholder dairy farming can be used as an avenue for improving the education status in rural communities. This is in line with the findings of Khan and Rahama (2016) who alluded to the fact that smallholder dairy farmers utilise a significant chunk of their revenue towards education.

The mean health and wellness component score of the smallholder dairy farming households was 0.65 with a standard deviation of 0.17. The lowest recorded value among the farmers was 0.3 coupled with the highest value of 0.83. This indicates that dairy farming contributes to the wellness of the household. This is a reflection of the information in literature which shows that dairy farming contributes to improved nutrition for participating households through provision of milk to the diet and availability of funds to buy diverse nutritive foods (Hoddinott *et al.*, 2015; Slavchevska, 2015). Results from the study also showed that 81 % of the respondents agreed to the fact that they now afford to buy healthy nutritious food due to dairy farming. In addition, availability of food and nutrition was one of the major benefits which the respondents were highlighting as benefits of dairy farming to participating households, during the focus group discussion and participatory mapping. This is important especially for people living in rural areas, in poverty and faced with limited resource (Barbier *et al.*, 2016). Dairy farming can be a solution to the food and nutrition challenges.

The other dimension of human capital which was evaluated was workforce and employment. Results showed that the farmers had a mean score of 0.26. Workforce and employment score ranked the lowest of all the dimensions of human capital. This means that dairy farming enhances workforce and employment the least in terms of human capital. Even though it ranked the least, the value is still an appreciated contribution to the livelihood capital (human) of rural households considering the rural employment challenges (Dube, 2016). The contribution was mainly in the form of creation of employment through hired labour to assist with dairy related chores which were still low. These results raise the importance of diversification of livelihood strategies so that they complement the short comings of the other. In this case, another livelihood strategy which supports workforce and employment would contribute to the improvement of the score. Furthermore, these results could be as due to low reliance on hired labour opting for provision of labour by household members. Bhandari (2013), suggests that smallholder households make most use of unskilled household labour for carrying out agricultural activities. This is however in contrast to the study by Khan and Rahama (2016), who argue that dairy farming generates a significant amount of employment in India. Differences could be as a result of the fact that smallholder dairy production is more developed and organised in India than in Zimbabwe. As such better income earnings can be easily generated when markets are well organised and thus enabling farmers to hire labourers.

The last dimension of human capital considered for this study was enabling environment. Human capital can only be developed if the environment is conducive. Human capital development is facilitated by properly functioning institutions, processes and systems. Study results indicated that the smallholder dairy farmers in Nharira had a mean score of 0.36. This score was mainly attributed to the contribution of dairy farming towards the payment of school fees for children within the households. This was also raised as a major benefit for practising smallholder dairy farming during the focus group discussion and participatory mapping exercise. The participants buttressed how they had been able to send their children to school through dairy farming. Of interest is the fact that all participants indicated that none of their children ever dropped out of school due to dairy farming. This is in contrast to the argument put across by FAO (2016), which states that livestock production can result in child labour and school dropout. This could be as a result of the close proximity of schools to the dairy farming households. In addition, the smallholder farmers in Nharira have been exposed to various training workshops and participated in numerous research activities which could have influenced the value they place on education of their children.

The results presented in Figure 5.2 show the distribution of the dairy farming households across the human capitals index and components. Of interest is the 29% of the households which scored very well in terms of education component, coupled with low scores for the workforce and employment component. Concentrated household decision making in favour of education whilst neglecting investments towards employment and workforce could be attributed to the observation. This could be further explained by the principle of precedence which postulates that given limited resources, satisfaction of needs is more important than of wants (Morrow, 2015). As such, they dairy farmers might be prioritising education needs as compared to employment and labour needs.

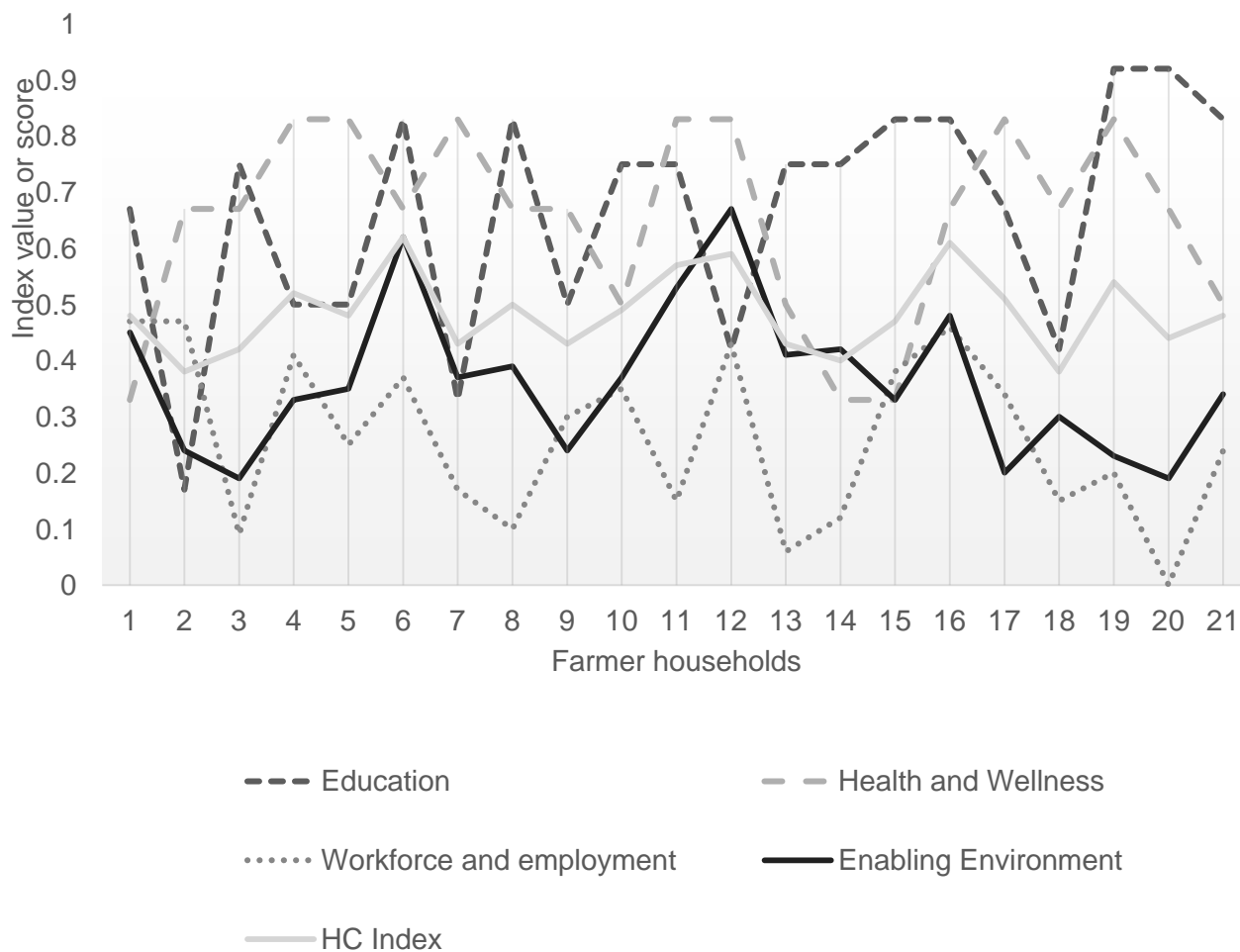
Men depicted the contribution of dairy farming towards human health on the participatory social map which they constructed (Figure 4.3). They depicted the presence of a clinic within the area in addition to the earlier mentioned toilets. Women and youth viewed health in relation to food and nutrition security (Figure 4.2 and 4.4). The map annotations produced by youth indicate that due to dairy, food is now available in households participating in dairy farming. Also, as the women were presenting their map they highlighted that the child they depicted on their map was taking bold healthy steps going to school as he is well-fed. This was in agreement with a score of 0.65 observed for health and wellness indicator (Table 5.3). These results were in line with the study carried out by Hoddinott *et al.* (2015), who conclude that smallholder dairy farming enhances nutrition and health of children at participating households. Good health and nutrition enable children to actively participate in school and thus contributing to their education.

Participatory social maps drawn by participants depicted benefits to human capital to include increased knowledge on dairy farming and cattle rearing; and efficient use of resources (Figure 4.2, 4.3 and 4.4). These were evident in the map drawn by the youth which pulled out linkages of the various processes which are related to dairy farming and how they contribute to efficient use of resources and recycling (Figure 4.2). Human capacity of the communal dairy farmer's household has been improved through driving skills. Participants indicated that they had cars, which need a licensed driver. Possession of cars ensures that one of the household members has a driver's license, who can operate the vehicle. A driver's license can be viewed as a skill which the holder can use to generate a livelihood strategy through taking up driving as an employment (Stradling, 2016).

**Table 5.3: Descriptive statistics for Human Capital Index and its dimension across households participating in the Nharira dairy farming scheme (N = 21)**

<b>Indices</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Workforce and Employment	0.26	0.148	0.00	0.47
Enabling Environment	0.36	0.133	0.19	0.67
Health and Wellness	0.65	0.174	0.33	0.83
Education	0.66	0.208	0.17	0.92
Human Capital Index	0.48	0.070	0.38	0.62

### Household Human Capital Index and component scores



**Figure 5.2: Distribution of households according to Human Capital index and component score**

In addition, ownership of cars act wealth status and also contribute to human health as the farmers will not have to walk long distances twice a day to go and deliver milk at the milk collection centre.

Not all the contributions of dairy farming to human capital are positive. The youth indicated that due to the taxing and non-seasonality nature of dairy farming, it is very challenging to get time to rest and relax. The women group also shared the same sentiment and expressed it as. They expressed the following sentiments,

*“zvinochembedza (it causes one to show signs of ageing).....if u want to be a dairy farmer just start thinking that you are going to work very hard, not to sleep, rest and talk” .*

This shows once one gets into dairy, time to rest will be very limited. They raised these issues during the focus group discussion. These results can be explained by the Self-determination Theory which postulates that motivation originates either from intrinsic or extrinsic factors in pursuit of a distinct outcome (Ryan & Deci, 2000). In this case, the dairy farmers might be having a strong urge to work hard in efforts to gain better returns from the enterprise. The urge could be due to an inherent zeal, competition or pressure from fellow farmers in an effort to improve their current social economic status. Consequently, they involve their children so as to share the labour.

## **5.5 Conclusions**

It can be concluded that smallholder dairy farming enhances or contributes positively to household social and human capital. Even though concerns with regards to the amount of labour involved in carrying out dairy chores and the tensions with non-dairy producing neighbours, negative contributions are outweighed by the positive ones. Household social capital portfolio benefits slightly more than human capital. In this chapter, a contribution to knowledge relating to the role of smallholder dairy farming (as a livelihood strategy) in shaping household capabilities (human and physical capital) is made. The next chapter focuses on the remaining three livelihood capitals (physical, financial and natural).

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## CHAPTER 6: CONTRIBUTION OF SMALLHOLDER DAIRY FARMING TO FINANCIAL, PHYSICAL AND NATURAL CAPITALS OF THE PARTICIPATING HOUSEHOLDS

### 6.1 Abstract

This chapter delves into the contribution of smallholder dairy farming towards livelihood assets (physical, natural and financial). Smallholder dairy farming is known to provide multiple benefits to the rural households. It is, however, important to understand the framing of the benefits in relation to the Sustainable Livelihood Framework so as to provide concrete evidence for its use as a channel for rural development. This chapter is based on empirical evidence obtained through a mixed method approach. Data was collected from 21 smallholder dairy farmers in Nharira through household surveys, focus group discussion and participatory mapping. Livelihood capital indices were formulated to measure the extent of benefit derived from dairy farming. Results showed that smallholder dairy farming enhanced natural capital (0.52) more than the other two capitals. Financial and natural capital obtained almost the same benefits (0.49 and 0.47, respectively) from the dairy farming. It can be concluded that smallholder dairy farming strengthens household physical, financial and natural capital of participating households. As such, dairy farming can be encouraged as a route for enhanced livelihood capitals for rural household. However there is need to determine other livelihood strategies which can be combined with smallholder dairy in order to strengthen household benefits.

**Keywords:** Household assets, livelihood strategy, smallholder dairy farming,

### 6.2 Introduction

Smallholder dairy farming is one of the agricultural enterprises which have the potential to contribute principally towards eradication of poverty and rural development. Livestock production has been identified as an important activity which plays a key role in achieving all of the 17 Sustainable Development Goals (SDGs) (FAO, 2016). Livestock production interact both negatively and positively with the planet, the people and the various processes which are captured in the SDGs (FAO, 2016). Considering that smallholder dairy farming practises have been encouraged (Kidoido & Korir, 2015; Chamboko & Mwakiwa, 2016) among the farmers in rural parts of the world as a livelihood strategy, it is vital to look at its interaction with household sustainable livelihood capital portfolio. Understanding this will enable planning for the future with regards to sustainability of rural livelihoods. The objective of this chapter was to determine the

contribution of smallholder dairy farming to household natural, financial and physical capital in Nharira, Zimbabwe. This helps to understand the linkage between smallholder dairy farming (as a livelihood strategy) and the household livelihood capitals.

Smallholder dairy farming is an important livelihood strategy which has potential to stabilise participating households' welfare, particularly in sub-Saharan Africa region (Ayanwuyi *et al.*, 2012). Revenue from the enterprise contribute towards education, health, food and housing expenses of the household participating in dairy farming (Ayanwuyi *et al.*, 2012). In addition, smallholder dairy farming enables investment in other businesses allowing for the diversification of incomes sources. A study carried out by Ulrich *et al.* (2012) in Kenya, revealed that better livelihood conditions are achieved through smallholder dairy farming. Livelihood strategies which strengthen or build up household livelihood capital portfolio are important as they enhance the ability of a household to deal with stress and reduces vulnerability (Wang *et al.*, 2015). This in turn provides the household with the opportunity to hedge against vulnerability through diversification of livelihood strategies.

### **6.2.1 Natural capital and smallholder dairy farming**

Natural capital comprises the natural resources such as the flora and fauna, land, air, water, and environmental services which are available to a household for the production of a livelihood strategy (Bhandari, 2013). Livelihood activities have an influence on the status of the natural capital which can result in its depletion or enhancement. Unlike other livelihood capitals, natural capital is not man made but its access, quality and availability is influenced by human activities (Perman *et al.*, 2003). About 430 million people live in marginal rural areas faced with arid and semi-arid conditions characterised by limited agricultural productivity due to moisture stress (World Bank, 2008). These harsh conditions affect the natural capital base which a household residing in such an area can have access to resulting in poor resource endowments (Dercon, 2006). Rural livelihood strategies are often based on natural environment even though it is under pressure. Natural capital based livelihood strategies usually pay off in the short run, and can only be sustained if there is sufficient investment in other forms of capital such as human and physical to compensate for the long run short comings (Brandt *et al.*, 2016). The livelihood strategies often exert further pressure on the natural environment. However, some of the livelihood activities have the potential to enhance or strengthen the existing natural resources.

Dairy farming is one of the agricultural activities that is heavily entwined around natural capital. Smallholder dairy in particular has a heavy reliance on the natural vegetation, water and land for the production and access to feeds for the animals. Dairy production activities also affect the natural environment in various ways including disposal of waste, overgrazing and provision of manure to the soil (Barrett *et al.*, 2002). The fact that smallholder dairy farming is a land based activity, coupled with the limited availability of land, conflicts are prone to erupt among farmers. The conflicts according to Pica-Ciamarra *et al.* (2007), are usually a result of insecurity of tenure. This in a way affects the social capital of the farmer through relationship tainting as highlighted in Chapter 5.

### **6.2.2 Physical capital and smallholder dairy farming**

Physical capital include the infrastructure, equipment, assets and goods that can be used to support a livelihood (Bhandari, 2013). Physical capital can be classified into basic infrastructure and productive equipment or goods according to Wang *et al.* (2015) and Yusoff *et al.* (2016). Basic infrastructure reflects the adjustments made to the physical capital environment so as to meet household or community needs, whilst production equipment entails the goods used for production and increased productivity (Thulstrup, 2015). Ownership of this capital enables a household to venture into various production based livelihood strategies such as dairy farming and other agricultural activities.

Participation in smallholder dairy farming activities has potential impact on physical capital portfolio of the household. Dairy farming activities can provide financial resources to fund improvement of livestock and farmer housing, acquisition of household assets such as bicycles motor bikes and vehicles (which are all considered to be part of physical capital), at household level. Dairy farming networks are an additional source of physical capital by means of providing equipment which facilitates dairy production. This is the case with NGOs and government institutions which sometimes provide farmers assets such as bicycles and milking cans.

### **6.2.3 Financial capital and smallholder dairy farming**

Smallholder dairy farming has the potential to reduce economic and social inequality within regions of a country (Bhandari, 2013). This is attained through the creation of employment and the provision of opportunities for rural households to participate in markets and earn some income. Ownership of financial capital is usually associated with a good economic standing because it can easily be converted into any other household capital (fluidity), depending on the

household needs. Physical and financial capital resources usually determine the livelihood options which is followed by a household. This is because almost all livelihood strategies need financing for their establishments.

Dairy farming is known for the provision of revenue which can be used to support various household needs (Foekena & Owuorb, 2008; Ulrich *et al.*, 2012). However, the practise also make use of a significant amount of finances in acquisition of inputs and stock for dairy production. Dairy farming, as any other business enterprise can result in a financial loss if not well managed. Production practises should be tailored in a way that minimises cost of production.

### 6.3 Materials and Methods

This chapter follows the methodology which is explained in Chapter 5. Study area, participants, study design and data collection methods were carried out in the same manner as spelled out in Chapter 5. Data were collected through household interviews, participatory social mapping and focus group discussion. A census of 21 smallholder farmers actively participating in Nharira dairy farming scheme, took part in the study.

#### 6.3.1 Calculating capital indices

Data used to calculate household indices were collected through questionnaires by means of face to face interviews. Data were captured and analysed using IBM SPSS 24. Household livelihood capital indices were formulated from the aggregation of specific component scores. Components scores were derived from variables listed in Table 6.1. Components were derived from the first phase of data collection and literature. The contribution of smallholder dairy farming to livelihood capital portfolio of participating households is considered whilst holding all the other factors constant (*ceteris paribus*). The same methods used for the computation of social and human capital, used in the previous chapter, are also applied for financial, natural and physical capital. The indices were derived such that:

$$0 \leq C_i \leq 1$$

Where  $C_i$  = *Specific household capital index* (adopted from Su & Shang, 2012; Wang *et al.*, 2015).

The house capital index values can be grouped into low (0 – 0.40), medium (0.41 – 0.70) and high (0.71 – 1) as adopted from Su and Shang (2012).

Physical capital index was divided into two components which are productive equipment and basic infrastructure, in this study. This classification was adopted from Mayunga (2007) and Wang *et al.* (2015), who weighed the components according to the quantity, quality and location. The same principle was applied for this study though weights were not applied to the specific variables for the computation of the component values. The following formula was used to compute the physical capital index:

$$PC = \frac{\sum(a + b)}{2}$$

Where:  $PC$  = household physical capital index

$a$  = household productive equipment component value

$b$  = household basic infrastructure component value

In computing the productive equipment components score, the variables considered are ownership of motor vehicle, bicycle, livestock, and number of cattle owned. Ownership of motor vehicle and bicycles is considered as productive assets because they provide means of transport which can link the household to various economic markets. Linkages of rural agricultural based households to formal markets facilitates earning of higher income from produce, and diversification into high value activities and commodities. Livestock ownership was measured in terms of the presence of beef cattle, poultry, goats and pigs at the household. Livestock can be used for various purposes by households and thus, they qualify as productive equipment. As an example, beef cattle can be used to provide draught power for field crop production. The number of cattle owned was also used to measure the strength of the productive equipment components.

Basic infrastructure component score was measured using the variables access to electricity, solar energy, improvement to housing and toilet quality. Access to electricity is important for sustaining livelihood options particularly non-agricultural income generating opportunities. The contribution of dairy farming in this regard was measured by determining if access to electricity and solar power was facilitated by funds or networks from dairy farming. Improvement to quality of households and toilets was also considered as a measure of basic infrastructure component score for this study.

Variables used for the formulating component values were mainly dichotomous in nature with few categorical and continuous ones (Table 6.1). Individual categorical and continuous variables were standardises using the formula:

$$y = \frac{x_i - x_{min}}{x_{max} - x_{min}}$$

Where:  $y$  = standardised variable  
 $x_i$  = the actual observed value  
 $x_{min}$  = the minimum observed value  
 $x_{max}$  = the maximum observed value

The component values were formulated as a mean of the observed variable scores per each household. The formula used is as follows:

$$a = \frac{\sum_{i=1}^n y_i}{n}$$

Where:  $y_i$  = standardised variables  
 $n$  = number of variables included in the construction of the component

The same formulas were used in computing natural and financial capital indices. However, different components were used. Household natural capital index was divided into two main components which are resource stock and resource access (Yusoff *et al.*, 2016). Resource stock covered the natural resources which the household were in possession of as a result of dairy farming. Resource access represented the benefits or negative influence from smallholder dairy farming which influenced household natural resources which are at their disposal, *ceteris paribus*. Specific variables which constituted the resource stock component are total amount of land owned by the farmers, fodder trees around the household, household borehole, private grazing land, and use of manure as soil fertiliser.

Specific variables used for computing resource access components were; use of biogas and whether the household owns a solar system set up through income from dairy farming. These variables considered household ability to access natural assets as a result of dairy farming. These natural assets could be utilised for other livelihood options so as to ensure sustainability of livelihoods.

The overall natural capital index was computed as follows:

$$PC = \frac{\sum(c + d)}{2}$$

Where:  $NC$  = household natural capital index

$c$  = household resource stock component value

$b$  = household resource access value

Financial capital was classified and measured according to three components which are income, savings and investments, and access to financial services as applied in the studies carried out by Mayunga (2007), Bhandari (2013) and Yusoff *et al.* (2016). The specific components of financial capital were computed from applying equal weights to each variable. Variables were assigned to each component depending on the way in which they contribute to household financial capital. Variables were generally dichotomous with a yes and no response except for the net income and income generation through manure sales.

Income component was computed from standardising and averaging a number of variables. Variables used ensured the income component captured the monetary and social aspect in constructing the score (Table 6.1). The variables used are net income for the year 2015, whether the household lends money to fellow dairy farmers, send remittances to family members, paying a non-dairy related loan or debt and sell manure. Net income was determined by the following formula;

$$\text{Net income} = \text{Sales} - \text{Expenditure}$$

Where:

$$\begin{aligned} \text{Expenditure} &= \text{Running cost} \\ &= \text{feeds} + \text{animal health} + \text{transportation of milk to collection centre} \\ &+ \text{hired labour} + \text{cattle pen maintenance} \end{aligned}$$

$$\text{Sales} = \text{quantity of milk produced} * \text{selling price} (\$0.75)$$

The milk which was used for household consumption was included so as to capture its monetary value. In addition. Milk used at households represented the drawings which were factored into calculation of income.

Another variable which was factored into the calculation of the income component is whether the farmer sometimes lends money to fellow dairy farmers. This was considered to be an indication that the household has some money to spare in the short run, which they lend to their peers. The

same understanding was applied to households which send remittances to other family members and those that pay a non-dairy farming related loan or debt. However, in the long run, paying of a loan or debt can be viewed as a shortcoming whereby household income from dairy farming would be falling short of the expenses. Participation of a household in selling manure was considered as an additional source of income which is dairy related and thus, contributed positively to the income component.

Saving and investment component was calculated using the variables membership in SACCO and other informal saving schemes, holding a bank account, and if a household uses cattle for barter trade. Farming household participation in SACCO is believed to increase agricultural output and employment (Devi & Govt, 2012). All households indicated that they did not hold any insurance policies which they were paying with funds from dairy farming, and thus it was not factored in during formulation of savings and investment component.

Variables which constituted the access to financial aid are whether the farmer took any form of loan in the past five years, if they have borrowed some money from fellow farmers and if they are paying any dairy related debt. In addition, the perceptions of the farmers on the likelihood for them to access loans was included as another variable. These were used as indicators to the ability of the farmer to access financial services as a result of dairy farming.

The three components amalgamated to formulate the overall financial capital of smallholder dairy farming households in Nharira. The same method used for financial and physical capital were applied. The specific formula for financial capital was computed as:

$$FC = \frac{\sum(e + f + g)}{3}$$

Where:  $FC$  = household financial capital index

$e$  = household income component

$f$  = household saving and investment component

$g$  = household access to financial aid value

**Table 6.1: Variables used in computing physical, natural and financial capital indices**

<b>Capital Index Component</b>	<b>Variable Used</b>
<b>Physical Capital</b>	
<b>Productive equipment</b>	Household cattle herd size, Ownership of a car, Whether car was bought by funds from dairy farming, Ownership of bicycle, Whether bicycle was acquired through dairy farming, Beef cattle production, Goat production, Chicken production, Whether chicken production was set up as a result of dairy farming, Pig production, Whether pig production was set up through dairy farming
<b>Basic Infrastructure</b>	Access to electricity, Ownership of a solar system, Toilet type at household, Whether toilet was built as a result of dairy, Improved housing, Ownership of another house in a different location
<b>Natural Capital</b>	
<b>Resource stock</b>	Total land owned, Availability of fodder trees at household, Use of manure for soil improvement, Ownership of private grazing land, Ownership of borehole.
<b>Resource access</b>	Ownership of biogas production system, Ownership of solar system set up through dairy
<b>Financial Capital</b>	
<b>Income</b>	Net income from for dairy enterprise for the year 2015, Sending remittance, Paying debt, Lend money to dairy farmers, Sell manure
<b>Savings and investment</b>	Membership in SACCO, Membership in a saving scheme, Ownership of bank account, Use dairy cattle for butter trade
<b>Access to financial aid</b>	Sometimes borrow other farmers, Paying a dairy related debt, accessed a loan in the past years, Access to dairy related loan

## 6.4 Results and Discussion

### 6.4.1 Natural capital

Results in Table 6.2 show that smallholder farmer households participating in Nharira dairy scheme had a mean natural capital index of 0.52 with a standard deviation of 0.196. This shows that the natural capital portfolio of the households is enhanced by participating in smallholder dairy farming. The household which had the least natural capital index value scored 0.10, coupled with a maximum of 0.8 for highest ranking household (Figure 6.1). This score represents the natural capital benefits which were derived from smallholder farming. Increased access and quality of natural resource base of smallholder dairy farmers plays a significant role in the sustainability of rural livelihoods and act as resilient and coping strategy in times of disaster (Hunter *et al.*, 2011; Nawrotzki *et al.*, 2012). This is because rural livelihoods are mainly natural resource based and thus, its improvement presents benefits to the household. Figure 6.1 indicates that a number of households had a high resource access score coupled with a low resource stock score. This means that farmers who benefited most with regards to resource access score had very low resource stock benefit from dairy farming. This could be as a result of scarcity influencing economic choices, of either opting for enhancement of resource access or the enhancement resource stock (van Rianne *et al.*, 2016). Achieving both might be a mammoth task in the face of limited resources.

The natural capital index was computed from resource stock and access scores which were identified as the components of natural capital. The households scored averages of 0.47 and 0.57, respectively. Mean natural resource access score for the households ranked above the average with a minimum of zero and a maximum of one (Table 6.2). The results show that the farmers benefited more in terms of access to natural resource access as compared to improvement in resource stock. Access to natural resources provides livelihood source for poor households living in rural areas, though the extraction methods are often not friendly to the environment (Su & Shang, 2012). Even though the average score for resource access is the highest of all the components, some (19 %) of the households had a score of zero coupled with 33 % of the households scoring a component value of one (Figure 6.1). High scores of natural resource access can be attributed to the use of biogas, which the smallholder farmers are engaged in. This was initiated as one of the dairy farming scheme project in efforts to optimise the use of by-product of dairy farming. Biogas is produced from cattle dung. The smallholder farmers were aided in establishing the biogas production systems which they use mainly for

cooking and powering refrigerators. Use of biogas conserves the environment as the farmers will not have to cut down trees for firewood (Mengistu *et al.*, 2015).

The results obtained from participatory mapping and focus group discussion (Chapter 4) further cement the above findings. All the participants identified presence of bio digesters at households. Moreover, they highlighted that energy from the bio digester is used to power household assets such as fridges, televisions and boreholes as shown on the maps (Figure 4.2, 4.3 and 4.4; Chapter 4). Youth produced a map which appreciated a lot of the contribution towards natural capital (Figure 4.2). Even though all the groups of participants agreed to the production of biogas energy as a benefit derived from dairy, the youth went on to highlight a further benefit from biogas which is the reduction of deforestation as farmers no longer rely heavily on firewood as an energy source. This can be viewed as a ripple effect benefit from dairy farming as cow dung is a by-product of dairy farming. Cattle dung is important as a fuel for energy production through the bio digester and for improvement of soils (Yasar *et al.*, 2017). During the production of biogas, slurry produced is also used as a manure to soil. They also pulled out the reduction of global warming as a positive contribution brought about through the use of cattle dung for biogas production. Production of biogas from manure is a sustainable alternative source of energy in addition to being an environmentally friendly cattle waste management system (Ozor *et al.*, 2014).

The map produced by the youth placed emphasis on the importance of a borehole at the households. They related the presence of borehole at households to dairy farming through income earned. This is evident by the connectedness of all the other map features to the borehole. The group for men also depicted household access to underground water through wells and boreholes. All above mentioned map features point at the contribution of smallholder dairy farming to natural capital. Rural areas in Zimbabwe are not serviced with running water facilities, as such, access to underground water provides a safe and reliable water source for livestock and household use (Zvavahera, 2012). Dairy animals use significant amount of water (FAO, 2016) and this could have necessitated the farmers to set up underground water sources.

The natural resource stock specific household scores are indicated in Figure 6.1. The scores suggest that dairy farming households benefit in this regard though not as much as compared to resource access. This could be because it is a mammoth task, if not impossible, to increase the natural resources stock such as land owned and private grazing land due to its unavailability (Perman *et al.*, 2003). Where available, land often comes at high price which smallholder farmers cannot easily afford (Timmer, 2017). In addition, ownership of a household borehole is sometimes

not possible due to the low water table at the household location. This makes improvement of the natural resource stock often challenging.

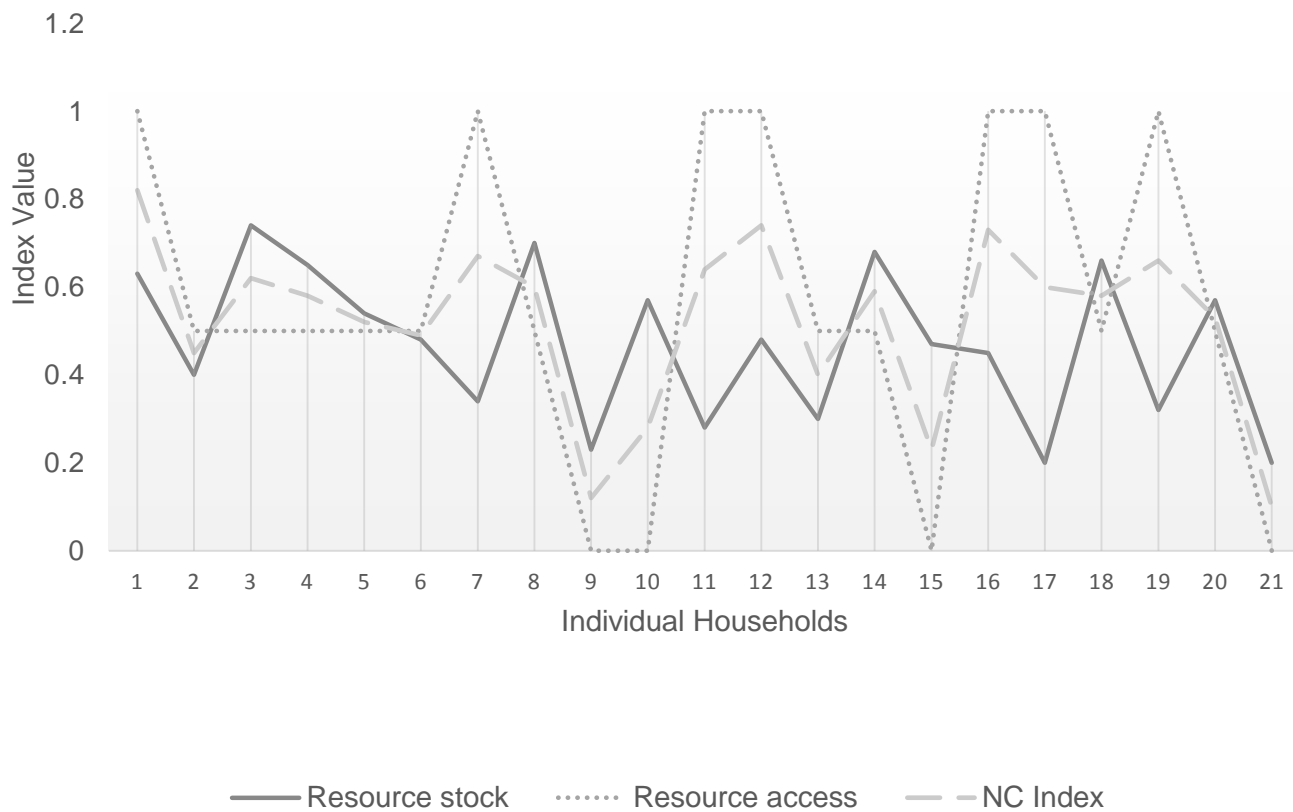
However, almost all households (85 %) indicated that they used manure as a fertiliser for their fields. This resource stock is also an important way of improving soil nutrient content at a low cost and at the farmers' convenience especially for households residing in rural areas. Adding manure to the soil contributes to the enhancement of the soil as a natural resource. Improved soil quality enables diversification of agricultural livelihoods. Marenya and Barrett (2007), indicates that land is one of the most important assets for smallholder farmers, through which they produce food and generate income. Consequently improvement of its quality enables a farmers to venture into various agricultural based livelihood strategies. Furthermore, Barrett *et al.* (2002) and Marenya and Barrett (2007), urge that smallholder agriculture is characterised by poor soil quality and inability to make investments in soil conservation practises resulting in loss of productive agricultural land. On the contrary, results from the study shows that smallholder dairy farming can contribute to the improvement of the soil through the provision of manure for the replenishing of agricultural land.

Negative contribution to resource stock component was raised by the participants of mapping exercise (Chapter 4). Only the adult females group raised a negative contribution of dairy farming to natural capital (Figure 4.4). This highlights the importance of forming various discussion groups as different viewing lenses are used by various groups, ensuring that wholesome understanding of the phenomenon is achieved. They indicated that communal grazing lands are under stress and no longer adequate to feed their cattle on. This is understandable considering the growing cattle herds which was reported by the farmers. Consequently, grazing land conflicts often arise due to competition on the natural resource (Amare *et al.*, 2017). Such negative competition is not healthy for the relations of the household and fellow community members.

**Table 6.2 Distribution of Natural capital Index and its dimension across households participating in Nharira dairy farming scheme (N=21)**

<b>Component and Index value</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Natural Resource stock</b>	0.47	0.173	0.20	0.74
<b>Natural Capital index</b>	0.52	0.196	0.10	0.820
<b>Natural Resource access</b>	0.57	0.364	0.00	1.00

### Household Natural Capital Index and Component Score



**Figure 6.1 Distribution of households according to natural capital index and component score (N=21)**

### 6.4.2 Physical capital

Results show that the smallholder farmers in Nharira had an average physical capital index of 0.47 with a standard deviation of 1.38 (Table 6.3). The household with the least index value scored 0.29 in contrast to the 0.73 value for the household with maximum value. Results show that the natural capital portfolio for the participating households benefit more than the physical capital one. The distribution of individual household's natural capital index score is shown in Figure 6.2. It is interesting to note that none of the households had neither an index value nor a component value of zero. This reflects that irrespective of the characteristics of the farmer, they still accumulate some level of physical capital benefits. Moreover, household production equipment score plot was moving along with basic infrastructure score plot (Figure 6.2). This reflect that households benefiting more in terms of production equipment were doing equally well in terms of basic infrastructure. The same applies to the households which scored low values. This could be as a result of the close linkage between the two indicators.

Participants' household physical capital index was mainly supported by the basic infrastructure component which had a mean score of 0.53. This indicates that smallholder dairy enhances access to basic infrastructure for the participating households. Participating in smallholder dairy farming in Nharira enhances the ability to access electricity, and solar energy in addition to improvement of housing and toilet quality. Access to modern energy sources is vital for the enhancement of economic, social and environmental aspects of human development (Donohue & Biggs, 2015). From results from of maps drawn by men and women practicing communal dairy farming (Chapter 4), it is evident that features representing physical capital are the most dominant (Figures 4.2, 4.3 and 4.4). The groups indicated numerous physical changes that happened around the farm houses. The maps depict improved housing as represented by the building materials and size. The new houses built by the farmers are bigger, built with materials such as asbestos roofing and with proper ventilation (windows) as compared to the thatching on houses before practicing dairy farming. Men group articulated the transitions very well by showing the houses before and after the contribution of dairy farming (Figure 4.2, 4.3 and 4.4). Milbourne (2012), indicates that the quality of building materials used for construction of housing can be an indicator of poverty especially in rural settings. Improvement of housing by dairy farming households can thus be linked to reduced poverty levels. Next to the farm house there is evidence of the presence of a blair or pit toilet which is another important asset which also contributes to the wellbeing of household members. Access to such infrastructure is important for the sustainability of the household and strengthens the capabilities of a household in diversifying

livelihood sources. Improved housing and toilets contributes positively to the health and wellbeing of the household member and reduces vulnerability to bad climatic conditions and diseases outbreak (Cairncross *et al.*, 2010; Curtis *et al.*, 2011).

Productive equipment's score was relatively lower (0.41) as compared to basic infrastructure (Table 6.3). However, the score still reflects a significant contribution of smallholder dairy farming to physical capital portfolio of participating households. This result can be attributed to the increasing cattle herds of the farmers as a result of dairy farming. Increased cattle herds enables the expansion of the dairy farming enterprise whilst contributing to the strengthening of the draught power and beef herd (Kumar & Singh, 2016). This is in line with the findings from the mapping exercise and focus group discussion wherein the youth group, together with the female group identified ownership of cattle as another benefits of smallholder dairy farming (Chapter 4). In their presentation, the female group indicated that the cattle herd increases faster for dairy farmers as compared to other farmers.

An increasing cattle herd size is vital for smallholder rural households as it signifies stored wealth, which can be used as adaptation and mitigation measures against shocks. Cattle can be sold and converted into other forms of capitals or slaughtered to act as a source of food, depending on household needs (Lubungu *et al.*, 2016; Orchard *et al.*, 2017). These results are in line with the notion that cattle serve as savings in rural areas, due to mistrust and lack of financial institutions (Ellis, 2000). In general, rural household strive to have huge herd size, thus dairy farming is one of the ways to achieve this. In addition, dairy farming contributed to the ownership of bicycles (another variable for productive equipment) through loan system. Household ownership of such equipment enhances linkages to better input and output markets. This enables a household to access productive inputs and sell their output at competitive prices which works better for the farmers (Hussein & Nelson, 2016). Additionally, a household is better connected to other services and social networks if in possession of transportation to get them from place to place.

The participatory maps also show that dairy farming has made contribution to the purchasing of motor vehicles. This was raised by the women group. These vehicles are useful for transportation of milk to the dairy in addition to the basic functions of a car at a household. However, Ulrich *et al.* (2012) urge that on-farm livelihood strategies do not yield significant contributions to physical asset accumulation. This might be due to the definition of on-farm livelihood strategy which focused mainly on field crop production coupled with insignificant livestock rearing. Even though it was the women's group which identified a car, the men's group went on to show the presence of a road linking households to Nharira milk collection centre. A road is an infrastructure which

benefits the participants beyond the household, but as a community. The participants further pulled out physical features related to dairy farming which are now present at the household. These include milking parlour, milking cans and well fenced paddocks. Men pulled out the transition from using the “indigenous kraals”, to paddocks among dairy farming households.

### 6.4.3 Financial capital

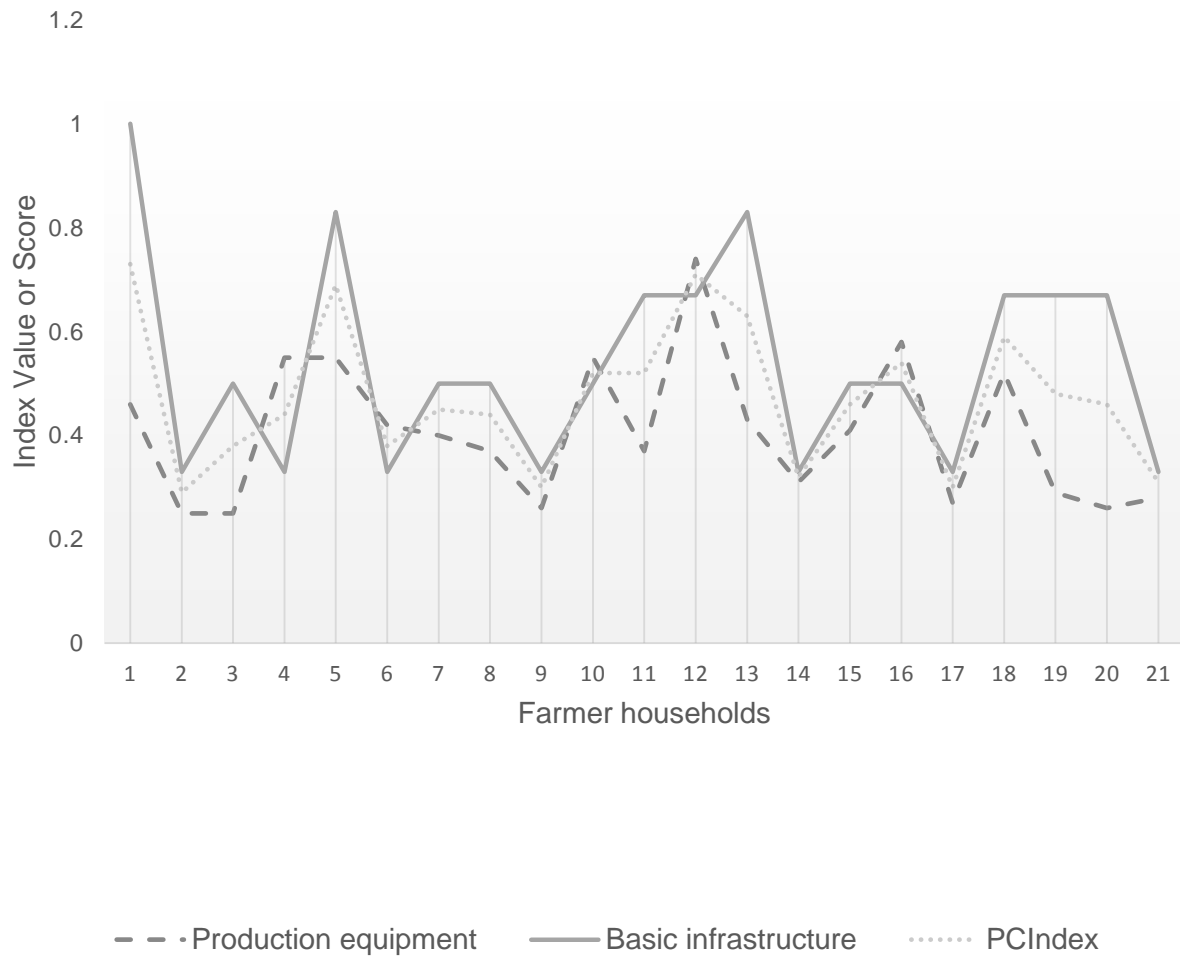
Results shown in Table 6.4 indicate that smallholder dairy farming in Nharira contributes to an average financial capital index of 0.49 with a standard deviation of 0.17. The households which had the least index value were pegged at 0.15, which was quite low in comparison to the recorded maximum of 0.83. The low value can be attributed to savings and investment scores which were as low as zero. Of significance is the observation that none of the households had a financial capital index value of zero. This shows that all households participating in smallholder dairy farming had financial capital benefits accruing to themselves. This is supported by literature which reveals stable source of income as one of the benefits of smallholder dairy farming (Ayanwuyi *et al.*, 2012; Rao *et al.*, 2016). This is one of the major and vital contribution of smallholder dairy farming to livelihoods. This is because income earned through dairy farming can easily be covered into any other forms of capital or invested through livelihood diversification. These results are in line with the findings from the mapping exercise and focus group discussions which highlights that the households afford to pay for the various expenses as a result of dairy farming (Figure 4.2, 4.3 and 4.4). Furthermore, focus group participants indicated that various community members are earning income through working for the dairy enterprises and processing plant. Even though this result is not household specific, it spells out the contribution of smallholder dairy to livelihood capital.

Figure 6.3 displays the individual household score values for financial capital and its components. The results show that about 81% of the households had different component scores which varied along the curves in the same manner. This means that the households which had higher values of income score also did well with access to financial aid and savings. The same is applicable to household which did not score high values. This is expected as the components are measuring the same aspect which is financial capital.

**Table 6.3 Distribution of Physical Capital Index and its dimension across households participating in Nharira dairy farming scheme (N=21)**

<b>Component and Index value</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Productive equipment</b>	0.41	0.136	0.25	0.74
<b>Physical Capital index</b>	0.47	0.138	0.29	0.73
<b>Basic infrastructure</b>	0.54	0.197	0.33	1.00

### Household Physical Capital Index and component score



**Figure 6.2 Distribution of households according to physical capital index and component score (N=21)**

The highest component score was recorded for financial aid which was 0.67 (Table 6.4) with a standard deviation of 0.252. None of the households had a score below 0.25. This shows that dairy farming contributes positively to the households' access to financial systems and institutions. Smallholder farmers in rural areas are known to have limited access to financial institutions which provide loans and other financial assistance due to unavailable collateral and unstable source of income (Demirguc-Kunt *et al.*, 2014). Smallholder dairy farming in Nharira, however provides a number of options which the farmers can tap into for short term and medium term loans. Of significance is the inter farmer informal loans which the farmers give to each other, enabled by their participation in smallholder dairy (Malik & Gautam, 2016). One farmer is able to provide the loan because of the income from dairy, whilst on the other hand the farmer is able to take the loan counting on dairy farming income for repayment. Some local credit institutions such as SACCO are more likely to give a dairy farmer a loan than a non-farmer as they are considered to be less risky in terms of evading payment.

The smallholder dairy farming households in Nharira dairy scheme had a mean score of 0.43 with a standard deviation of 0.18 for the income component. Cash income is known to be a challenge for rural households. However, results of the study indicates that smallholder dairy farming enhances income for participating farmers. This is because the farmers produce and sell the milk for most parts of the year, enabling them to earn cash for household use. Results indicate that 71 % of the households had a positive net income balance from dairy farming for the year 2015. Cash income enables households to participate in cash markets which often offer better product price range. This finding is supported by Thulstrup (2015) and Xu *et al.* (2015), who argue that access to cash markets offers better opportunities for diversification of livelihood strategies and economic activities. In addition, households with access to cash are in a better position to address the various expenses which they are faced with such as payment of school fees, buying food and clothing. It is interesting to note that some of the farmers were able to send remittance to their children, pay loans and lend other farmers money, due to dairy farming. This is related to the financial aid score discussed above. The smallholder dairy farmers are able to act in such a manner because of the cash fluidity facilitated by dairy farming.

About 19 % of the households which participated in the study had a savings and investment score of zero in face of a mean score of 0.36 (Figure 6.3 and Table 6.4). The smallholder dairy farmers had a low score in terms of savings and investment. This is an indication that even though the farmers are getting substantial amounts of income from dairy, it is still not enough for a number of households to channel it towards savings. Most of the households reported not to have bank

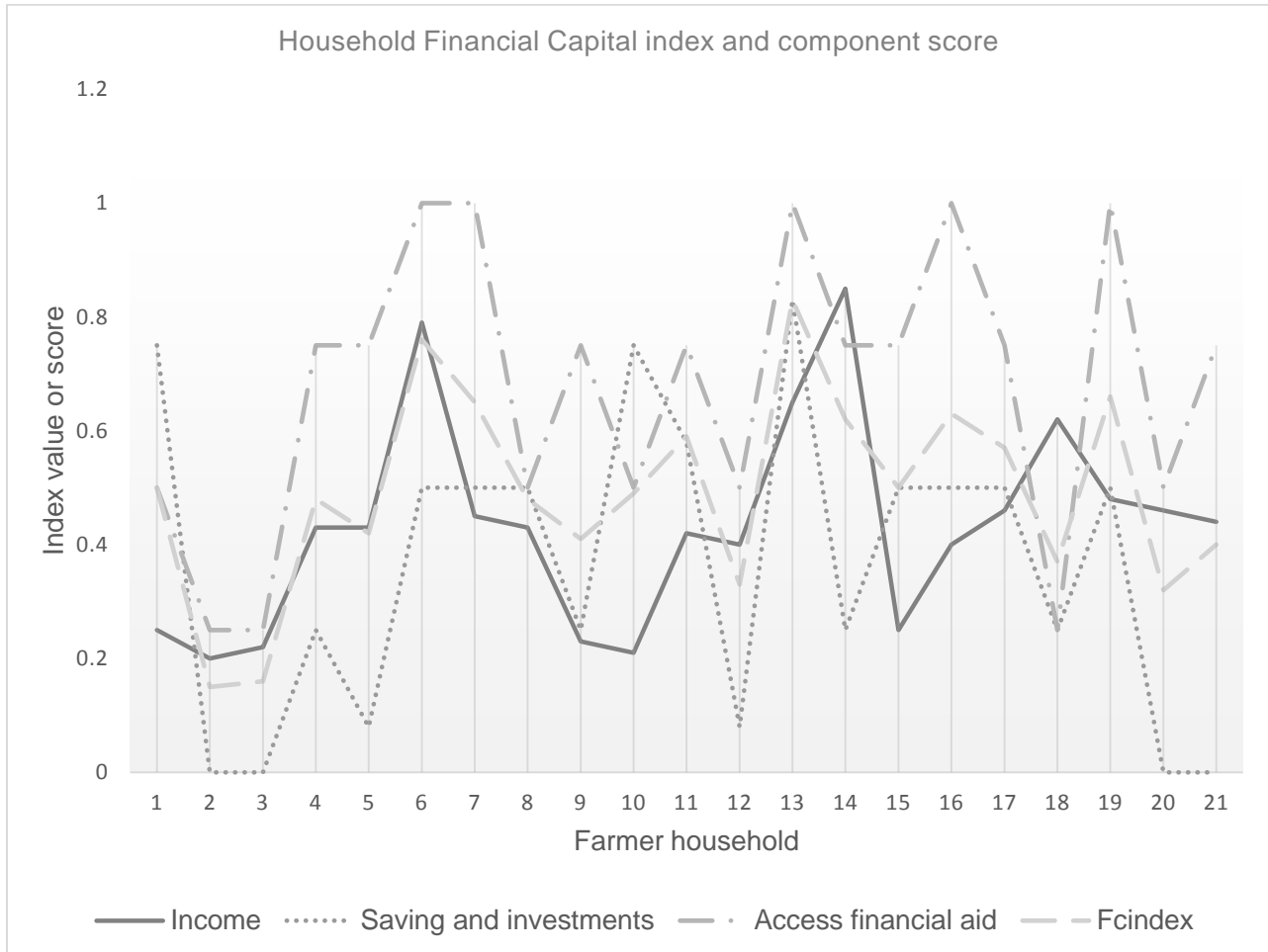
account (86%). This observation is in line with claims made in the World Development financial inclusion report which noted that about 32 % of adults in Zimbabwe have accounts in financial institutions, of which more than half are mobile money accounts (Demirguc-Kunt *et al.*, 2014). This could be attributed to the general lack of trust in financial institutions due to the 2007- 2008 economic crash which resulted in people losing their money which was in most banks in Zimbabwe (Demirguc-Kunt *et al.*, 2014). Roy *et al.* (2014), indicates that social trust plays an important role in people participation in financial institutions. In addition, banks are also located in towns meaning that the transaction costs faced by individual staying away in rural areas is increased due to transport cost. In contrast to this is the 62% of the households which reported to be members of informal saving scheme. This reflects the important role played by informal saving schemes in rural areas. Their success could be attributed to the low transaction costs and interest rates on loans; and convenience (Devi & Govt, 2012; Bwana & Mwakujonga, 2013). Regardless of the low savings and investment score, it is still an important reflection of the positive contribution of dairy farming to the financial capital portfolio of the participating households. The low component score concurs with the findings of Demirguc-Kunt *et al.*, (2014), who indicated that saving is an important financial risk hedging strategy which pays off in the event of emergency financial needs and thus, contributing to resilience of the household.

The above discussed results were further strengthened by the findings from the mapping exercise and focus group discussion (Chapter 4). During the mapping exercise and focus group discussion, all the participants were showing the contribution of dairy farming to financial capital through identifying the assets and activities they pay for with income from dairy. Women group pointed out that they now afford to buy cars and to take their children to schools and universities. They went on to depict on their map a stack of cash which they explained as a financial stability state (Chapter 4; Figure 4.4). During presentation of maps, the women group highlighted that they were now acting as a source of credit to the other community members.

Youth group wrote on their map about the reduction of money spent on feeds as a result of own production of fodder and pastures (Chapter 4; Figure 4.2). They further indicated the reduction of money spent on fertilizers as dairy farming provide manure for the field crops. Use of manure on field crops by smallholder farmers enriches food crop fields at a no additional financial cost to the household (Masvaya *et al.*, 2017). This means that the dairy farming households are able to use the money they would have used for acquiring fertilizers for other household needs.

**Table 6.4 Distribution of financial capital Index and its dimension across households participating in Nharira dairy farming scheme (N=21)**

<b>Component and Index values</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Savings and Investment</b>	0.36	0.268	0.00	0.83
<b>Income</b>	0.43	0.181	0.20	0.85
<b>Access to financial aid</b>	0.68	0.252	0.25	1.00
<b>Financial capital index</b>	0.49	0.175	0.15	0.83



**Figure 6.3: Distribution of households according to financial capital index and component (N=21)**

Interestingly, men depicted a shop on their map, which can be interpreted as the ability to buy their needs from the shop or the ownership of businesses. All these interpretations are indicators of financial capital contribution of dairy farming to livelihoods of participating households. Most of the indicators of financial capital which were depicted on the maps can easily be classified under other forms of capital. This shows the easy transferability of financial capital to other forms of livelihood capital. Wang *et al.* (2015) agrees that financial capital fluidity support diversification to

off-farm livelihood strategies. This makes financial capital one of the most desirable livelihood capital as it can be converted to suit the household need with ease.

## **6.5 Conclusions**

Furthermore, it can be concluded that smallholder dairy farming has a positive contribution to the natural, physical and financial capital of the participating households in Nharira. However, natural capital portfolio benefited the most, followed by financial then physical, though the marginal difference was small. Thus, based on the findings of this study, it is evident that households practising dairy farming have benefits accruing, which strengthen their livelihood capital portfolios, enhance resilience and reduce vulnerability. The strengthening of the capital portfolios enhances levels of resilience and reduction of vulnerability of the household to shocks, and this is highly desirable for sustainability of rural livelihoods. To understand the wholesome contribution of smallholder dairy farming to livelihood of household in Nharira dairy, a synthesis chapter is necessary. Thus, a synthesised summary of the benefits and negative contribution of dairy farming is outlined in the next chapter.

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## CHAPTER 7: SYNTHESIS OF CONTRIBUTION OF DAIRY FARMING TO HOUSEHOLD LIVELIHOOD CAPITALS OF FARMERS IN NHARIRA, ZIMBABWE

### 7.1 Introduction

Poverty and malnutrition are some of the challenges that rural households in developing countries face (Lawson *et al.*, 2017). Such challenges emanate from a myriad of sources and manifest differently in various regions. About 900 million people around the world live in poverty (FAO, 2016). Various development organisations have tried availing aid to heavily affected regions in desperate moves to address the challenges (Lawson *et al.*, 2017). However, providing handouts to households is a short term solution to the challenges, but unsustainable in the long run as the beneficiaries are not empowered to solve their own problems. Consequently, arguments postulating that aid is one of the primary cause of poverty and under development in African region have risen (Carmody, 2016). Challenges faced are even more pronounced within the rural households in sub Saharan Africa (SSA). Effects of climate change have worsened the situation through exerting pressure on the strained natural resources such as water and land (Dube, 2016). This is because rural livelihood strategies are mainly natural resource based with low financial investments.

Smallholder agricultural production is one of the natural resource based livelihood strategy which is favourable for rural based households in Africa. Such production is critical for achieving food security in SSA (Ericksen *et al.*, 2009). Through smallholder dairy production, farmers from different parts of the world have recorded various social economic benefits (O'Brien & Cook, 2016). These regions include India, Bangladesh, Ethiopia, Uganda and Kenya (Gebreegziabher & Tadesse, 2013; Thirunavukkarasu *et al.*, 2014; O'Brien & Cook, 2016). This practice enhances household food availability and income. Smallholder dairy farming has the potential to provide enhanced benefits to the participating household as compared to crop production (Al-Atiyat, 2014). Addressing household poverty through increased market participation and productivity can be achieved through smallholder dairy farming. In addition, household food availability and nutrition is enhanced through improved milk production and consumption.

Smallholder dairy farming is one of the livelihood strategy which is known to provide various benefit to practising households. In Zimbabwe, dairy farming initiatives were introduced by the government in 1983 as a tool for enhancing rural development through poverty alleviation and improvement of nutrition (Mupunga & Dube, 1992). Nharira dairy farming scheme is one of the product of the initiative. Such schemes were set up in the form of dairy milk hubs where

processing centres were set up across the country. The model enables farmers to produce milk solely at their household and market collectively through the dairy centre. The centre then processes the milk into various products which are supplied to various markets. Farmers are paid off fortnightly for the milk supplied to the processing centre. This set up ensures that the dairy farmers have a readily available market for their milk despite the relatively low quantities produced (Chamboko & Mwakiwa, 2016). Availability of locally available ready market for milk produce is important for the farmers as it significantly reduced transaction and marketing costs. High transaction and marketing costs often hinder smallholder farmers from accessing and participating agricultural markets (Hoddinott *et al.*, 2015). The burden is bulbous when it comes to smallholder dairy farmers due to the high perishable nature of milk coupled with poor handling facilities. The schemes are member runs and profits are shared accordingly. Nharira dairy is one of the schemes which survived the economic downturn which hit Zimbabwe during the 2004 to 2008 period. However, volumes and specific participants changed over time.

The resilience of rural livelihoods is under threat in face of political, environment and economic climatic threat (Shiferaw *et al.*, 2014; Chanamoto & Hall, 2015). As such, it is imperative for development agency to better understand the structures, characteristics, benefits and negative impacts of the various livelihood strategies adopted by rural households in order to make appropriate decisions in light of the turbulent circumstances. Understanding this contributes towards making appropriate decisions towards achieving the SDGs. Sustainable livelihood framework provides a structure for viewing and understanding livelihoods and the contexts which they operate in (Ellis, 2000). This framework was opted for in this current study as a way of better understanding the contribution of smallholder dairy farming to livelihood capitals. According to the framework, a household opts for a livelihood strategy depending on its capital portfolio. Five livelihood capitals were identified according to the DfID classification, and these are financial, physical, social, human, and natural ( DfID, 2000). However, through engaging in a particular livelihood strategy, the structure of the household capital portfolio is bound to change either positively or negatively. This change helps to apprehend the contribution of the livelihood strategy towards sustainable livelihoods and unearthing the role it plays in achieving the SDGs. The current study focused on understanding how smallholder dairy farming changes livelihood capital portfolio of participating households.

Some studies in literature focus on the effect of livelihood capital portfolio on household livelihood strategy and diversification (Alwang *et al.*, 2005; Fang, 2013; Zenteno *et al.*, 2013). However, the current study focus was unique in that it focused on the flip side of the argument, zooming into

the contribution of a livelihood strategy (smallholder dairy farming) on livelihood capital portfolio. Understanding this relationship is important for sustainability.

The main objective of this study as indicated in Chapter 1 was to critically analyse the contribution of smallholder dairy farming towards achieving sustainable livelihoods within practising households in Nharira dairy scheme, Zimbabwe, in order to suggest relevant measures to improve rural livelihoods. This was done through; a) determining the characteristics of the dairy farmers, and b) identifying the positive and negative contributions of smallholder dairy farming towards livelihood capitals.

The findings of this study provide deeper insights into the realities of smallholder dairy farming at household level. It unravels both positive and negative changes that smallholder dairy farming introduced, taking into account improvement or depletion of livelihood capitals. Government policies are crucial for achieving sustainable transformation of the smallholder dairy production systems (World Bank, 2006). This can only happen if there is a clear understanding of the contribution of smallholder dairy farming to the livelihoods of the participating farmers. Such evidence helps in the crafting of well-informed policies that can be implemented in support of the practice. The knowledge also ensures that there is proper targeting of improvement strategies and presumably enhance smallholder dairy farmers' livelihoods.

In this chapter, a synthesis of the whole study is provided in order to present a clearer and more comprehensive picture. The methodology employed and major findings are presented in relation to the study objectives for the dairy farmers is presented. A qualitative cost and benefit analysis and a typical household livelihood capital pentagon are presented as a way of synthesising the contribution of smallholder dairy farming to livelihoods. The chapter concludes by suggest relevant measures and recommendations for improving rural livelihoods of smallholder dairy farmers, research and policy.

## **7.2 Synthesis of the Study**

As already been alluded to before, the aim of the study was to critically analyse the contribution of smallholder dairy farming to livelihood capitals of household in Nharira, Zimbabwe. Chapter 1 provided the background and outline of the problem, setting the scene for the study. The study is based on the DfID Sustainable livelihood Framework concept. This is expounded on in Chapter 2. Chapter 3 provides the step by step guideline on the various methodologies used in this study. This was done in such a way that ensures replicability. Furthermore, the methodology used is

presented in a synthesised form in the following section of this chapter. Characterisation of the smallholder dairy farmers according to socioeconomic, demographic, production and biotechnical factors is outlined in Chapter 4. It is imperative to understand how household characteristics shape livelihood decisions, choices and behaviours (Peng *et al.*, 2017). This provides a framework for designing livelihood intervention strategies or programs.

Contribution of smallholder dairy farming to livelihood capitals is presented in Chapter 5 and 6. These two chapters presented components (specific livelihood capital scores) of household livelihood capital index attributed to dairy farming, which is presented as part of this synthesis chapter. A typical smallholder dairy farming household livelihood capital pentagon in relation to dairy farming, is formulated and presented below. Furthermore, a synthesis of the positive and negative contribution of dairy farming to livelihoods is presented in the form of a qualitative pros and cons analysis which is presented below. This analysis provides a clear picture of the benefits and costs of carrying out smallholder dairy farming obtained through the various methodologies used. Relevant measures are then recommended for the improvement of rural livelihoods. In addition, this chapter presents the recommendations for policy and research. A policy brief was generated and is presented as Appendix 10.

### **7.3 Methodological Imperatives**

In the current study, a sequentially integrated mixed method approach was used to as the design of the study. The study was based on the qualitative and quantitative research paradigms. This was divided into two phases with the first phase being exploratory and qualitative in nature with results feeding into the second phase which was quantitative and confirmatory. The design was suitable for this study because the researcher sought out for an in-depth understanding of the contribution of smallholder dairy farming to rural livelihood. Specific objectives which were explored were mentioned in section 7.1 above.

Prior to data collection, community entry activities and social preparation were carried out so as to recruit participants, get permission and raise awareness on the study. A triangulation of community entry activities was used so as to ensure buy in from the smallholder farmers. Firstly, a community entry and recognisance visit was undertaken by the researcher so as to assess the situation on the ground and get acquaintance with present time realities of the dairy scheme. Recognisance trip was enabled by already existing networks with some of the dairy farmers. Researcher met with the secretary of Nharira dairy scheme and some prominent farmers. Secondly, a community entry visit was undertaken by the researcher so as to meet with farmers

and the management committee of the dairy scheme. Explanations were given to the farmers on the purpose of the study and how it would potentially benefit them and contribute to rural development. These multiple angels of community entry managed to get the study participants galvanised for participation in the study. Data collection tools for the first phase were designed in cognisant of the observed realities.

During the qualitative explorative phase, primary data was collected through focus group discussion, key informant interviews and participatory mapping. Participants of the focus group discussion and participatory social mapping were the smallholder dairy farmers and members of their households. A total of 14 individuals participated in the focus group discussions and participatory social mapping. These constituted three groups comprised of four men, five women and five youth. The groups were constituted according to gender and age dimensions so as to capture different views and to facilitate collective thinking. Four key informants were identified and interviewed. During all these activities, discussions were captured on a voice recorder and used to compliment notes taken. Moreover, the participants presented their focus group discussion and mapping results in a plenary session giving important annotations to their findings. Participatory social mapping provided the participants to visualise how their livelihoods are shaped or influenced by dairy farming. This method is usually applied in public health studies or in environmental studies (Pain, 2004; Chambers, 2006; Brett *et al.*, 2012) to get public views. However, in this study, social mapping way used in a non-spatial way to depict collective mental pictures of the contribution of dairy rural livelihoods. The results from this phase were then analysed through thematic content analysis and used to shape the questionnaire design for the second phase.

The quantitative phase was facilitated by a household focused closed-ended questionnaire, which was administered to all the 21 smallholder farmers who are members of the Nharira Dairy processing scheme. Quantitative phase also served as a feedback session on the findings of the first phase. This helped to further clarify to participants, how the current study fit into their own development. A high response rate (100%) was achieved in this study as an attribute to the investment in community entry activities. Response rate is a major issue with survey studies (Baruch & Holtom, 2008). The current study provides insights on enhancing response rate through comprehensive community entry activities.

The questionnaire was designed to measure the contribution of smallholder dairy farming to livelihoods from inputs from the first phase and literature. This ensured that the questionnaire was asking for information which is relevant to the study site. Quantitative data was also collected from

farmer records and the Nharira Dairy scheme records. These mainly provided information on the production information of the farmers. In addition, a smallholder dairy farming daily activity routine cycle (Figure 4.1) was developed from the focus group discussion results.

Data from phase two was captured, cleaned and analysed using SPSS version 24. Descriptive statistics were used to characterise the farmers according to production, demographic biotechnical and socio economic factors. Indices were formulated for the contribution of dairy farming to natural, physical, financial, human and social capital. Indices were formulated under *ceteris paribus* assumption, from various factors. This means that the livelihood capital indices were related to dairy farming whilst holding the other factors constant. The factors used took cognisance of the context specific variables which shaped livelihood capitals.

In the current study, triangulation of data sources and techniques were used to ensure that an in-depth understanding is realised. In addition, validity and reliability was enhanced through triangulation. In this study, the Sustainable livelihood framework components were applied in measuring household level outcomes of a livelihood strategy (smallholder dairy farming), through various data collection sources and techniques. Using various methods is important in capturing and representing the aspects of people's lives and their context. Lack of recognition of people specific aspect and context is identified as one of the weaknesses of application of the Sustainable Development Framework (Adato & Meinzen-Dick, 2002). Thus, this study is unique in that it provides insights framed around the sustainable development framework with recognition of the context specific people aspects.

In summary, the current study was carried out in a holistic manner in applying the sustainable livelihood framework to analyse the contribution of smallholder dairy farming to livelihood capitals of households in Nharira through mixed method approach. In the following sections, major results of the study are synthesised to present an unabridged picture of the findings in Chapter 3 to Chapter 6.

#### **7.4 Limitations of the study**

The study was based on the case of Nharira which limits the applicability of the recommendations on a wider scope. As such, we recommend that further similar studies to be carried out with a wider scope so as to better inform the situation at national level. In addition, a study addressing targeting improvement of efficiency and labour productivity is recommended. This would provide answers to the challenges of taxing work associated with dairy farming.

## 7.5 Characterisation of Smallholder Dairy farmer

The major findings from this study indicates that the smallholder farmers have similar dairy demographic, infrastructure, milk delivery, calf rearing and production characteristic. Similarities enabled the crafting of the smallholder dairy farming routine schedule (Figure 4.1). This is in contrast to the findings of Hostiou *et al.* (2015), who recorded varied workloads and work organisation across smallholder dairy farmers in Brazil. The schedule depicts a typical day for a smallholder farmer outlining the various activities which are carried out at every point. This contribution can potentially help in the identification of areas where efficient methods and practises can be applied so as to lessen the workload. Furthermore, this can help farmers to make more informed decisions about workload management for their dairy enterprise. This would also afford farmers the time for leisure and rest. In addition, options for labour division can be crafted using the schedule so as to ensure dairy farming enterprise efficiency. However, differences were noted in some regards.

The findings of this study indicate that farmers are generally above the retirement age with very low participation of youth as enterprise owners. The farmers were predominantly women regardless of the marital status. Considering the various benefits which dairy farming avail to participation households, youth involvement will play a huge role in alleviating employment problems in rural areas. Youth have also the potential to perform better if they participate in dairy enterprise as they are more receptive to new ideas and technology as compared to old people (Packalen & Bhattacharya, 2015). Implications for development from these findings is the need for strategies that involve youth in dairy enterprises as owners. This can potentially contribute positively to the national milk output of the country. Additionally, participation of women empowers them in terms of owning and running a revenue generating enterprise (Johnson *et al.*, 2015). This enables women living in the rural area to be in better positions to make decision and thus, take charge of their financial needs.

The current study findings indicate that the smallholder farmer's received training in most aspects surrounding dairy farming. However, they still have a challenge in implementing the gained knowledge so as to improve their practice. This highlights the need to focus on strategies to enhance knowledge application as compared to further training. Rural development practitioners need to first determine the need to weigh out the actual problem before they make investments in training, when the actual challenge is rather an implementation one.

Study findings also revealed that most of the farmers had substantial experience carrying out dairy farming under mixed crop - livestock production system. Uptake of AI was still very low across the farmers who mainly carry out selective breeding. Mixed crop-livestock production system ensures food availability across households through both streams of production (Dube, 2016). This enhances household resilience to food insecurity. Improving the dairy herd is best achieved through AI, however, its low uptake is hindered by cost. This implies that farmers can be trained on how to better utilise selective breeding for herd improvement. The use of communal grazing land and production of pastures and fodders by the farmers play a significant role in reducing the cost of production (Chanamoto & Hall, 2015). This is important particularly for new entrants as they would require less start up investments in this case. Production of pastures and communal grazing also enables the farmers to keep the dairy calves for other purposes at the household. This allows for the increased head size of the dairy producers.

Some differences were noted on the characteristics of the farmers. Major differences were noted in the land holding size and cattle ownership. This is because of the linkage between the two. Farmers with less amount of land are constrained from growing their cattle herd due to limited grazing area. This in turn affect the levels of production as land availability act as a growth constraint. These have a huge impact on the level of dairy production thus, resulting in differences across farmers.

Small differences across the smallholder farmer group enable blanket solutions or strategies to be applied for the whole group of farmers. Implication for these findings for rural development is that crafting of intervention strategies or policies in a blanket format can be done. This will be able to address the needs of almost all dairy farmers. However, it is imperative to note areas where the farmers differ so as to ensure appropriate action.

## **7.6 Contribution of Smallholder Dairy Farming to Livelihood Capitals**

The current study presented a critical analysis of the contribution of smallholder dairy farming to household livelihood capital. Critical analysis was achieved through using various methodologies to understand livelihood capital structure as explained in section 7.3 above. Furthermore, the application of the sustainable livelihood framework enabled a structured and holistic understanding of the livelihood capitals in relation to dairy farming.

Findings from the current study reveal that smallholder dairy farming contribute positively to all livelihood capitals within households (Chapter 5 and 6). This is supported by the sentiments from

one participants, who indicated that, “Zvakanakira dairy hatingazipedzi. Tinotoda zuva rese” (We cannot exhaust all the good things which dairy farming has brought to us. We will need a full day to do that). In general, smallholder dairy farming enhances all livelihood capitals of households participating in smallholder farming. The degree of contribution is almost the same across all the livelihood capitals. However, social capital has the highest index value (0.59) as compared to the rest of the capitals as shown in Table 7.1. Physical capital benefit the least from smallholder dairy farming. Household livelihood capital index was computed as an average of the five livelihood capital index score for each household. Cronbach’s alpha coefficient was computed to measure the reliability of using the five capitals in measuring Household livelihood capital. The variables were found to have an acceptable moderate reliability coefficient of 0.65. Yusoff *et al.*( 2016), acknowledges that an acceptable Cronbach’s Alpha coefficient should be above 0.60. This method of checking for reliability was used as an addition to the ones alluded to in section 7.3 above. Households were classified into three categories according to livelihood capital index (Table 7.2). Of interest is the fact that a household participating in smallholder dairy farming had an average livelihood capital index value of 0.51 with a minimum score of 0.31 and a maximum score of 0.69 (Table 7.1). Households participating in smallholder dairy farming in Nharira fall under the medium livelihood capital index. This results suggest that a household can survive fairly well on smallholder dairy farming and can potentially diversify into other livelihood options.

The mean livelihood household capital structure attributed to dairy farming is depicted in Figure 7.1. The capital pentagon / radar (Figure 7.1) give an overall picture of the contribution of smallholder dairy farming to livelihood capitals. The pentagon depicts the mean household capital portfolio strength for smallholder dairy farmers. Higher degree of robustness of the radar corresponds to higher level of capital benefits derived from dairy farming. The distribution of the households across the each specific livelihood capital is shown in Figure 7.2. Figure 7.2 shows the livelihood capital ownership patterns attributed to dairy farming across the smallholder households in Nharira. The figure gives a summative picture on how households are benefiting from dairy farming.

The findings of the current study suggest that smallholder dairy farming is a viable livelihood strategy for households residing in the rural areas. Its strength lies in its ability to enhance all the livelihood capital of the participating households. Livelihood capital ownership by a household enable diversification into other options, enhance household resilience and reduce vulnerability to shocks and risks. These findings implies that smallholder dairy farming can be encouraged as a tool for enhancing household livelihood capital for rural development. Nevertheless, this should

be done through careful planning, in collaboration with the farmers so as to properly manage the workload and grazing capacities.

In order to better understand the relationship among the livelihood capitals, a Pearson Correlation test was carried out and the results are depicted in Table 7.3. The table indicates that there all the livelihood capitals are positively associated with each other at varying strengths though. Social and financial capital have the strongest association of all the livelihood capital (0.666). In addition, the two livelihood capitals have a significant linear relationship at 0.01 level. Social capital also has a moderate, significant (at 0.05 level) and positive association (0.504) with human capital. Same results were also observed for natural and physical capital with a correlation value 0.449 at 0.05 significant level. This implies that enhancing one of the capital can positively affect the other and vice versa. Such observations implies that changing the contribution of smallholder dairy farming towards social capital will result in a change in financial and human capital. Consequently, social capital occupies a key position among the rest of the capital. This observation is important for rural development practise where programs can be designed to enhance social capital benefits from dairy farming. This will in turn result in the improvement of human capital and financial capital. Relationship between natural and physical capital can also be viewed in the same way.

The rest of the capital combinations had low correlation scores (between 0.0089 and 0.398). In addition, the associations were found not to be statistically significant (Table 7.2). However, the low correlation score is an indicator that the capitals move along together through the associations are not strong. Positive correlations across the livelihood capital signifies the inter relatedness of the livelihood capital assets benefits from dairy farming.

**Table 7.1: Descriptive statistics for livelihood capital indices (N=21)**

<b>Index of capital</b>	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Physical</b>	0.47	0.138	0.29	0.73
<b>Human</b>	0.48	0.070	0.38	0.62
<b>Financial</b>	0.49	0.175	0.15	0.83
<b>Natural</b>	0.52	0.196	0.10	0.82
<b>Social</b>	0.59	0.186	0.26	0.95
<b>Livelihood</b>	<b>0.51</b>	<b>0.103</b>	<b>0.31</b>	<b>0.69</b>

**Table 7.2 Distribution of smallholder livelihood capital across households (N=21)**

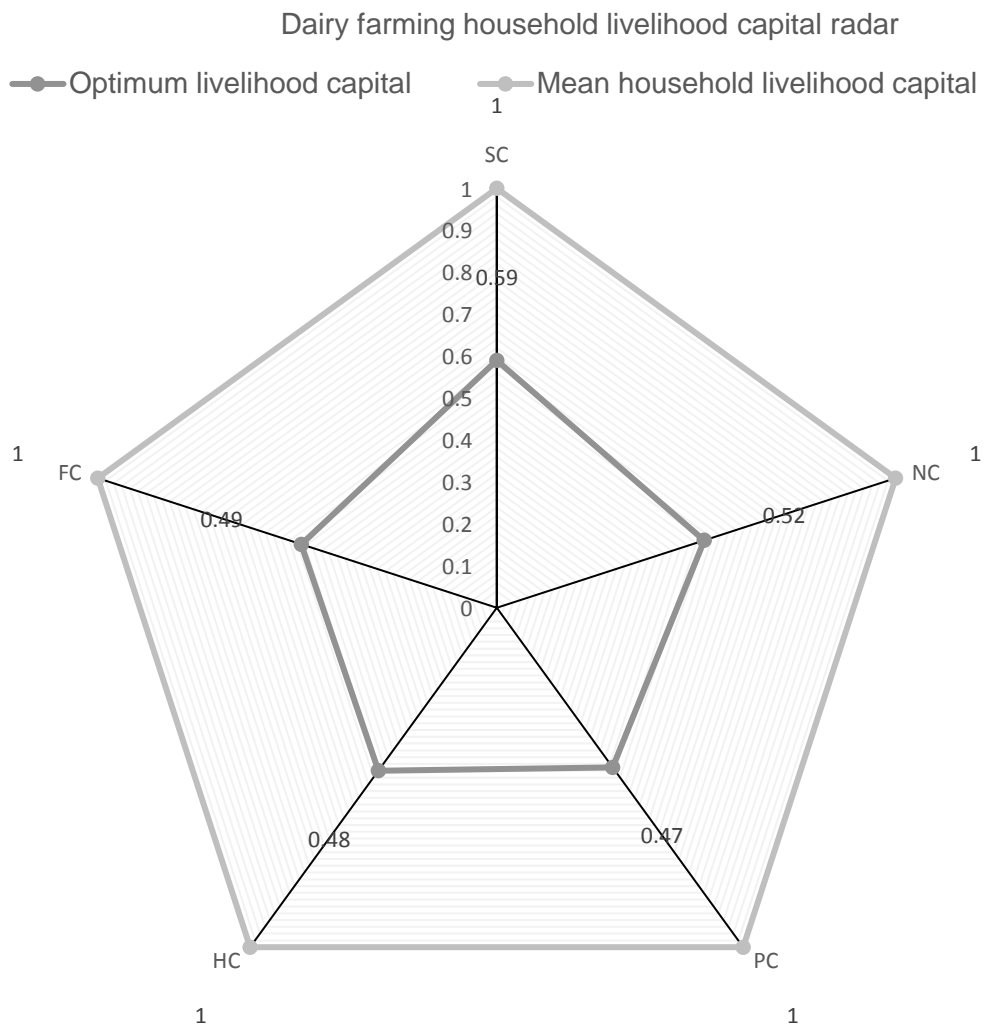
<b>Livelihood index classification</b>	<b>Frequency</b>	<b>Percentage</b>
<b>0.0 - 0.33 (Low)</b>	1	4.8 %
<b>0.34 – 0.66 (Medium)</b>	19	90.5 %
<b>0.67 – 1 (High)</b>	1	4.8 %

**Table 7.3 Pearson Correlation for the household livelihood capitals (N=21)**

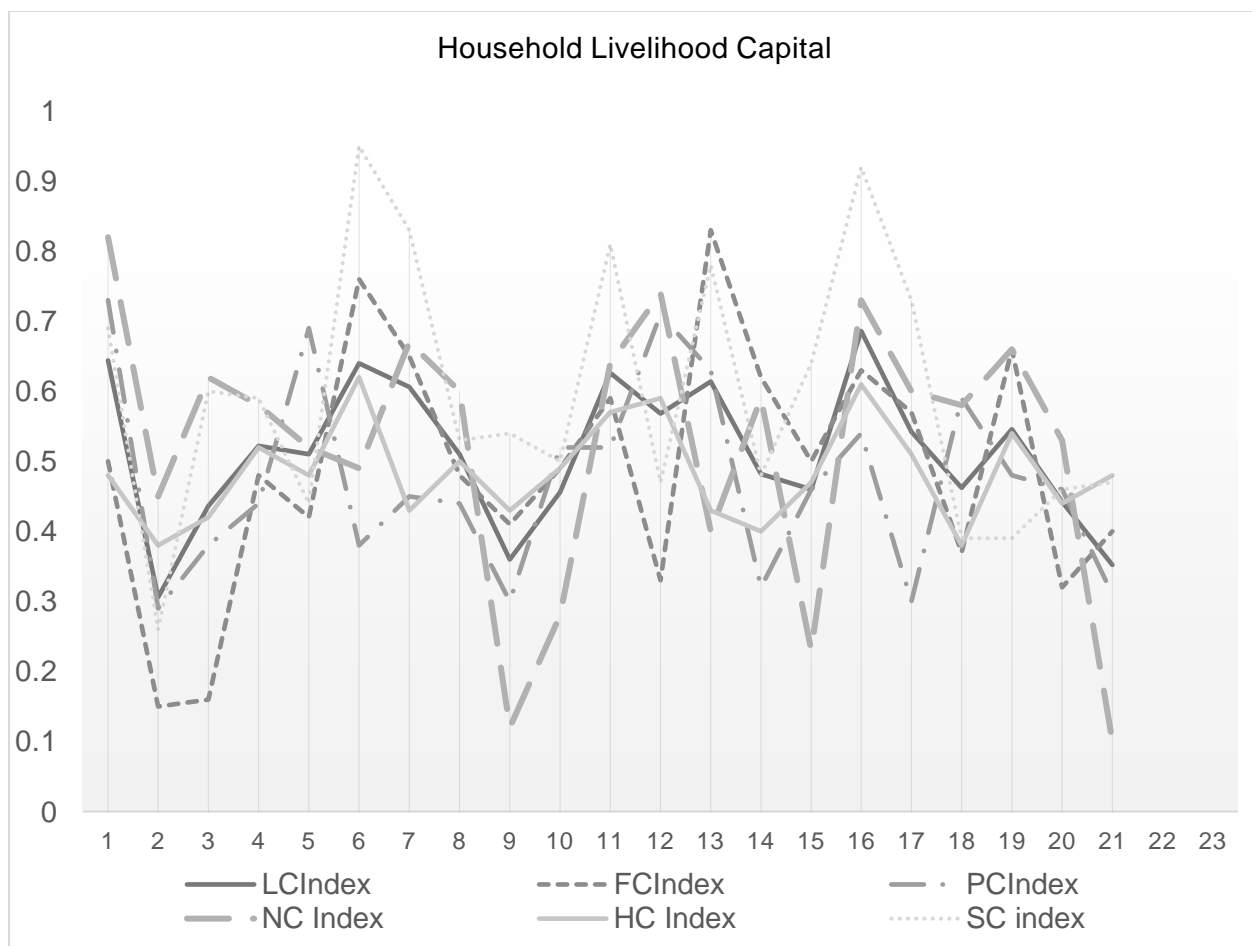
Index of capital	Social	Human	Natural	Physical	Financial
<b>Social</b>	1	0.504* (p=0.02)	0.216	0.089	0.666** (p=0.001)
<b>Human</b>		1	.297	0.234	0.398
<b>Natural</b>			1	0.449* (p=0.04)	0.105
<b>Physical</b>				1	0.143
<b>Financial</b>					1

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).



**Figure 7.1 Aggregate Sustainable livelihood index radar**



**Figure 7.2 Distribution of households across livelihood capitals**

The current study provided important insights on the contribution of livelihood strategy to household capital portfolio. A number of studies have applied the sustainable livelihood framework in understanding rural livelihood structure. These had different focal points such as the role of livelihood strategy on poverty alleviation (Ansoms & McKay, 2010; Soltani *et al.*, 2012); livelihood capitals as determinants of livelihood strategy (Ulrich *et al.*, 2012; Zenteno *et al.*, 2013); factors determining livelihoods (Fang, 2013); multidimensional dynamics of livelihood strategies (Alwang *et al.*, 2005, Van den Berg, 2010). However, none of these studies focused on understanding the contribution of livelihood strategy to the household capital pentagon. Shivakoti and Shrestha (2005), carried out a closer study which focused on livelihood capital pentagon as a measure of the performance of irrigation systems. The study suggested a framework for analysis but did not test it in real life context. Even though the above mentioned study pulls out the relationship between a livelihood strategy and capital portfolio, it has a specific focus which is irrigation. However, the current study provides insights related to smallholder dairy farming.

Table 7.4 summarises the findings of the study in the form of a social pros and cons analysis. The table further indicates the implications for rural development and contribution of the findings to the body of knowledge.

**Table 7.4 Qualitative Pros and Cons analysis of the smallholder dairy farming to households**

Research Objective	Pros	Cons	Implications for Rural Development	Contribution to the body of Knowledge
e) To identify the positive and negative contributions of smallholder dairy farming towards social and human capital within households in the Nharira dairy scheme	<b>Social Capital</b>			
	<ul style="list-style-type: none"> <li>Farmer provide loans to other community members in need and vice versa</li> <li>Farmers have networks of dairy farming friends from within the community and across the country whom they share ideas with and learn from</li> <li>Creates friendship among members of the scheme</li> <li>Social security due to a large network of friends</li> <li>Membership in various dairy related organisations</li> </ul>	<ul style="list-style-type: none"> <li>Cause tensions as non-dairy farmers become jealous of the dairy farmers herd</li> <li>Non dairy farmers are unwilling to take part in cattle herding turns with dairy farmers</li> <li>Disputes over grazing land</li> </ul>	Rural settings are known for strong social capital base. The additional social capital brought by smallholder dairy farming is vital for the sustainability of livelihoods. Rural development programs need to take advantage of the abundant social capital and find ways to divert it into meaningful livelihood strategies. In addition, rural development initiatives should ensure be designed in ways which avoid tensions amongst participants.	<ul style="list-style-type: none"> <li>The study contribute to the literature on livelihood benefits and costs of smallholder dairy viewed through the lenses of the sustainable development framework. This is relevant literature with potential to inform the pathway of achieving the SGDs.</li> <li>In addition, mixed method were used in the current study to measure the contribution of smallholder dairy farming to livelihoods of participating households</li> </ul>
<b>Human Capital</b>				
	<ul style="list-style-type: none"> <li>Income from dairy used to pay for school fees for children at various levels of education</li> <li>Milk provide nutritious food for the family</li> <li>Households better positioned to nutritious foods</li> <li>Creation and provision of employment at households and dairy centre</li> <li>Gained knowledge on business planning and management</li> <li>Farmers trained on various aspects of dairy farming</li> </ul>	<ul style="list-style-type: none"> <li>Too much work associated with dairy farming leaving no time for rest or leisure for households</li> </ul>	Rural development policies or strategies encompassing smallholder dairy farmers need to not be labour intensive. This will enable the farmers to participate in diverse livelihood strategies despite the high labour demanding nature of dairy farming. In addition, there is need for efficient, effective and sustainable utilisation of hired labour in a way that other livelihood strategies benefit beyond dairy farming. Hired labour can be used for other enterprises or livelihood options. Considering that a lot of ground has been covered on training related to dairy farming yet problem still exist with regards to record keeping, it is vital to design training objectives with the trainees so as to ensure that they are willing to implement the learnt practises. Smallholder dairy farming has potential to provide rural employment on farm and off farm. On farmer Smallholder dairy farming can be used as a strategy for human development in rural settings through improved education, employment, nutrition and health.	
f) To identify the positive and negative contributions of smallholder	<b>Physical Capital</b>			
	<ul style="list-style-type: none"> <li>Erection of boreholes at households</li> <li>Ownership of bicycles, and cars which connects the household to various service areas</li> </ul>		Dairy farming can be used as a strategy in rural settings to enhance household ownership of assets, access to clean water, energy and sanitation and in	<ul style="list-style-type: none"> <li>The study further contributes to the literature on how household</li> </ul>

dairy farming towards physical, natural and financial capitals within households in the Nharira dairy scheme;	<ul style="list-style-type: none"> <li>• Fast growing cattle herd which can be used for various household needs</li> <li>• Access and use of solar and biogas energy systems</li> <li>• Improvements to quality of housing and toilet facilities</li> <li>• Enhancement of the cattle handling and housing facilities</li> <li>• Acquisition of dairy farming equipment</li> </ul>		<p>the process contributing towards attainment of the SDGs.</p> <p>Use of biogas which is a clean source of energy, can be encouraged even to rural households who rear cattle for other purposes. This can play a huge role in solving the issue of deforestation.</p> <p>Due to the hygienic requirements for participation in dairy farming scheme, farmers are more likely to invest in setting up a secure water source. This contributes to access to safe drinking water in rural areas.</p> <p>Furthermore, smallholder dairy farming can potentially enhance quality of housing and improvement of sanitation in rural areas of Zimbabwe.</p> <p>To sum up, smallholder dairy farming can be used to improve the quality of life for rural livelihoods</p>	<p>livelihood capitals and asset pentagon is reframed due to participation in smallholder dairy farming as a livelihood strategy.</p> <ul style="list-style-type: none"> <li>• Using the sustainable livelihood framework in evaluating poverty alleviation and nutrition focused projects by means of triangulating data sources and collection methods is another contribution of the study to the body of knowledge. This is well explained in the earlier sections of this chapter.</li> <li>• Human development measures were used to determine the contribution of smallholder dairy farming to livelihoods</li> </ul>
	<b>Natural Capital</b>			
	<ul style="list-style-type: none"> <li>• Source of manure for biogas energy production</li> <li>• Improvement of pastures and planting of fodder trees</li> <li>• Access to own household borehole water</li> <li>• Use of manure as fertiliser</li> <li>• Improvement of agricultural land through use of manure</li> </ul>	<ul style="list-style-type: none"> <li>• Over grazing due to overstocking</li> <li>• Cow dung contributes to global warming</li> </ul>	<p>Smallholder dairy farming can be used for enhancement of natural resources in rural setting. However, this can be fully achieved if overstocking issues are addressed. Farmers need to be better informed on the impacts of over stocking and how it can affect their operations in the future.</p>	
	<b>Financial Capital</b>			
<ul style="list-style-type: none"> <li>• Stable income source</li> <li>• Ability to buy and pay for various household needs</li> <li>• Ability to offer employment to other community members</li> <li>• Access to financial markets</li> <li>• Send money to support family members staying other parts of the country</li> <li>• Setting up of SACCO which provide short term loans</li> <li>• Access to short term loan</li> <li>• Participation in informal saving schemes</li> </ul>		<p>Rural development programs which seek to address the cash income challenges need to consider smallholder dairy farming as an option. However, this is only achievable if marketing structures are put in place as is with the case of Nharira dairy.</p> <p>Smallholder dairy farming also provides a pathway for enhancing access to both formal and informal financial institutions. Increased financial capital produces multiplier effects which enhances household self-sufficiency and access to other needs. This further reduces reliance on external funding and support from NGOs and government.</p> <p>It is vital for farmers to plan their production trends so as to ensure that they produce the milk throughout the year so as to keep the stream of money flowing.</p>		

## **7.7 General Conclusions and Recommendations**

A sequentially integrated mixed method approach was used to critically analyse the contribution of smallholder dairy farming to household livelihood capital in Nharira, Zimbabwe. The sustainable livelihood framework guided the conception of the study. Study findings were framed according to the livelihood capital pentagon in order to present a clearer picture on the livelihood elements which are enriched or affected by the enterprise. Current study findings reveal the importance of using mixed methods in achieving a comprehensive understanding of a phenomena. Of interest is the use of participatory social maps in social economic research.

Furthermore, current study findings discloses that smallholder dairy farming contributes positively towards all the livelihood capitals of participating household. More importantly, smallholder dairy farming can be used as an avenue for solving multifaceted rural development challenges. These challenges include poverty, poor nutrition, and access to education, employment, food insecurity, access to safe drinking water, poor housing, and access to clean energy, poor health and access to health services, access to formal financial and commodity markets. Findings from this study reveals that smallholder dairy farming reduces household dependency on government and NGO aid, and relatives) as the farmers will be in a position to address their needs through the various pathways availed by dairy farming. Consequently, smallholder farming enterprise can be used as a pathway for achieving SDGs for rural livelihoods.

The current study presented evidence that smallholder dairy farming is a viable livelihood strategy which can be used for the enhancement of the household livelihood capitals of households. This in turn contributes to the sustainability of rural household livelihood

### **7.7.1 Recommendations for policy, rural development and practice**

- a. The NGO and government should consider channelling of more funds in establishment and support of smallholder dairy farming schemes so as to improve rural livelihood beyond crop production. The government should consider going back to the initial direction of establishing and supporting smallholder dairy projects
- b. The support can even be channelled towards youth involvement in dairy farming particularly as a way of enhancing youth participation in dairy farming and agriculture. The Government departments working with youth can consider using smallholder dairy farming as a livelihood strategy for young people who have access to land and reside in rural

areas. The program might include incentivizing youth participation through targeted aid and training for dairy entrepreneurship.

- c. There is need for extension services to work with farmers with regards to appropriate herd sizes which they can keep. This can help to reduce the pressure on grazing land which result in conflicts and environmental degradation. Farmers can also be encouraged to intensify feeding practises so as to ensure that the cows kept for dairy are pen fed instead of being let out to the communal grazing lands.
- d. Due to limited amount of land available for food crop production and grazing, farmers should be encouraged to move towards intensification. The production of own fodder and pastures, and the processing of crop residues for later use would facilitate this. This is also handy for reduction of production costs.
- e. More farmer-to-farmer visits should be encouraged to enable peer motivation in the application of acquired knowledge into practice. This will play a role in bringing the gap between knowledge acquisition and its application.

### **7.7.3. Recommendations for further research**

Even though this study answered questions on contribution of smallholder dairy farming to livelihoods, further questions were raised in the process. As such, the researcher recommends the research studies answering the following questions:

#### **Production related:**

- a. What aspects of smallholder dairy farming can be enhanced so as to improve labour productivity and efficiency? This would provide answers to the challenges of taxing work associated with dairy farming.
- b. How can artificial insemination be made more accessible and attractive to smallholder dairy farmers?
- c. Are there significant differences between livelihood benefits obtained by smallholder and small scale farmers?
- d. What is the relationship between the size of dairy enterprise and the livelihood capital index?

#### **Livelihood related:**

- a. How does household livelihood capital portfolio affect the dairy farming enterprise? Resolving this question will fill the gap in the dual causality between livelihood strategy and capital portfolio. The current study focused on one way (how smallholder dairy affect livelihood capital) and thus, answering the above question will fill the gap with regards to smallholder dairy farming.
- b. What livelihood capitals combination are necessary for the establishment of smallholder dairy enterprise?
- c. What are the factors that facilitate youth participation in smallholder dairy farming and succession plan for the enterprise? This would enhance youth participation and ownership of smallholder dairy enterprises in the process improving sustainability of the initiatives. How can the smallholder farmers set up a clear succession plan for their dairy enterprises?
- d. How does dairy farming as a livelihood option work in context of other household strategies? Does benefits from dairy farming reduce as a result of adopting other livelihood strategies?
- e. There is need to further carry out similar studies on other livelihood strategies opted for by rural households so as to better understand the best alternative for strengthening household capital portfolio.
- f. There is need to carry out a nation-wide survey which involves a wider scope of farmers, than the current one. This will enable better decision making at national level.

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## **LIST OF APPENDICES**

### **Appendix 1: Letter of Consent**

#### **LETTER OF CONSENT**

10 April 2015

Dear Selected participant

You are being invited to participate in a research study on analysis of contribution of smallholder dairy farming to livelihoods. The study focuses on the socio demographic characteristics of dairy farmers; and the positive and negative contribution of dairy to livelihoods. I am Ms Hlekani Kabiti and am a PhD candidate at the University of Venda. This study is being carried out in fulfilment of the requirements of the PhD degree programme. I will be working with my four research assistants in the data collection process.

You have been selected to participate in this survey because of your knowledge in smallholder dairy farming. This research will require about 1-2 hours of your time. During this time, you will be interviewed about your experiences in smallholder dairy farming. The interviews will be conducted wherever you are comfortable.

There are no anticipated risks, harm or discomforts related to this research. Your participation in this research is completely voluntary. You are free to withdraw from the study at any time for any reason. By participating in this research, you may also benefit others by helping people to better understand the contribution of dairy farming to livelihoods. Participating will also help you to better appreciate the benefits being derived from dairy farming and identify areas of improvement.

Several steps will be taken to protect your anonymity and identity. Interviews will not contain any mention of your name, and any identifying information will be removed. The questionnaires will be kept safe in a locked filing cabinet at the University of Venda. All information will be destroyed within 5 years' time.

The results from this study will be used to write up my PhD thesis. In addition, journal articles will be published on the study so as to add knowledge on role of smallholder farming in sustainable livelihoods. The outcomes of the study will be presented to you and the rest of the participants so that you access the new knowledge generated. The policy recommendations will be disseminated to relevant institutions through a policy brief. However at all these stages, names of the study participants will not be mentioned.

If you wish to receive a copy of the results from this study, you may contact me at the telephone number 0027 717612290. If you have any other questions regarding this study or your rights as a participant in this research, you may also contact my promoter at 0027 15 962 9049

I have read (or have been read) the above information regarding this research study on the contribution of smallholder dairy farming on livelihoods

\_\_\_\_\_ (Printed Name)

\_\_\_\_\_ (Signature)

\_\_\_\_\_ (Date)

## Appendix 2: Stakeholder Mapping Tool

List down all the stakeholders in Nharira Dairy Scheme. For each stakeholder, populate the table below with descriptions of how they satisfy you. Assign values (1- 10)

Stakeholder	Contribution	Relevance	Willingness	Influence	Necessity of involvement
1.					
2.					
3.					
4.					
5.					
6.					

### Appendix 3: Record Review Guide

1. Farmer details(small scale and communal)
  2. Quantities of milk supplied supplies by the farmer
  3. Quantities of spoiled milk from farmer-Microbial , dirt, water and temperature spoilage
  4. Quality of milk- milk content(fat e.t.c)
  5. Selling Price
  6. Loans which farmer has
  7. Proceeds from dairy farming (dividends if any)
  8. Membership payments
- 10 Year period

## Appendix 4: Roll Out Plan For Community Entry And Checklist

Activity	Key Questions to be Addressed	Deliverable
Introduce the research project to the identified gate keepers	<ul style="list-style-type: none"> <li>Who are the key people that should be approached for research project approval</li> </ul>	<ul style="list-style-type: none"> <li>Approval by gatekeeper to carry out the study</li> <li>An annotated list of the key people or institutions who should grant permission</li> </ul>
Visit Nharira dairy processing center to introduce the project and seek permission from the manager	<ul style="list-style-type: none"> <li>What are the conditions associated with the approval to carry out the study</li> <li>What kind of records do they have?(performance, membership)</li> <li>Who are the farmers that contribute to the processing plant? How are the farmers grouped?</li> <li>What are the trends in farmer membership</li> <li>How do I locate the DDP personnel or extension officer working with the farmers</li> </ul>	<ul style="list-style-type: none"> <li>Approval by the Dairy processing plant manager to carry out the study</li> <li>A list of the kind of records kept at the processing plant</li> <li>Information on locating the management committee and the DDP officer</li> <li>An inventory or summary of the farmers involved</li> </ul>
Meeting with the dairy management and present the research project	<ul style="list-style-type: none"> <li>Have I got the permission to carry out the study and what are the conditions?</li> </ul>	<ul style="list-style-type: none"> <li>Approval by the Dairy processing plant management to carry out the study</li> </ul>
Meet with the leadership structures of the various committees of Nharira Dairy	<ul style="list-style-type: none"> <li>Have I got the permission to carry the study and what are the conditions?</li> </ul>	<ul style="list-style-type: none"> <li>Approval from the Nharira Dairy management committees to carry out the study</li> </ul>
Meet with the personnel from Dairy Development Program	<ul style="list-style-type: none"> <li>What kind of support and information can I get from the DDP personnel?</li> </ul>	<ul style="list-style-type: none"> <li>Approval to carry out the study from the DDP or extension officer</li> <li>An annotated list of support and information that is rendered by the DDP personnel</li> </ul>
Introduce the project to the local leaders and agree on dated which data collection can start	<ul style="list-style-type: none"> <li>Have I got the permission to carry out the study and what are the conditions?</li> </ul>	<ul style="list-style-type: none"> <li>Approval to carry out the study from the local leaders</li> </ul>

<p>Also get some institutional memories or stories for the leaders</p>		<ul style="list-style-type: none"> <li>• Dates which data collection can be started</li> <li>• Accounts of some events that have been happening with regards to Nharira Dairy</li> </ul>
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**Checklist of documents needed for community entry:**

- Ethical clearance letter from the UNIVEN research directorate
- Letter of approval and acknowledgement from the Institute for Rural Development
- 3 copies of the research proposal
- 20 copies of the summary of the research proposal and planned activities
- Diary for capturing data, contact details and key decisions
- Laptop to capture data
- Voice recorder

**Appendix 6: Participant register**

**DATE: November 2015**

**Event: Community Entry Activities**

**Venue: Nharira**

Surname& Initials	Male or Female	Community structure(s) you are a member of	Cell phone number	Email
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				

## **Appendix 7: Participatory Social Mapping guide**

### **Mapping Contribution of Dairy Farming to Livelihoods in Nharira**

**Facilitator's Name: Kabiti Hlekani**

**Participants: Interested Nharira Community Members (Those involved in dairy farming and those not involved)**

***Materials required: Flip charts, markers***

#### **Explanation of the Activity:**

You are requested to draw a map showing all the things in your environment which you believe are of importance to the introduction of dairy farming. As you draw, think about how dairy farming has contributed to your life, be it positively or negatively. Think about what dairy farming means to you. What are some of the things which you are now able and unable to do as a result of dairy farming? Think about where and how you and your household members live, work and the places you regularly visit and how dairy farming has affected that.

You do not have to be an artist for you to come up with the map. Feel free to use symbols, pictures, words and any other artistic effects which you may wish to add.

Feel free to ask questions at any point if any. Participation is voluntary and you can choose to withdraw at any point.

## **Appendix 8: Focus Group Discussion Semi-structured Interview Guide**

**Date:**

**Group facilitator:**

**Venue:**

**Social Group:**

**Number of participants:**

### **Discussion questions**

You are kindly requested to discuss and answer the following questions with a view in mind that livelihoods are shaped by natural, physical, financial, social, and human capital.

1. Describe a typical dairy farming routine that as a by a smallholder dairy farmer you follow on a daily basis. Indicate the role player for each task that you list down.
2. What do you regards as the positive contributions to your livelihoods which you derive from dairy farming?
3. What do you regard as the negative contributions to your livelihoods which are a result of dairy farming?
4. What must be done and by whom, to improve the benefits of rural livelihoods through smallholder dairy farming?

## Appendix 9: Household Questionnaire

### CRITICAL ANALYSIS OF THE CONTRIBUTION OF SMALLHOLDER DAIRY FARMING TO THE LIVELIHOODS OF HOUSEHOLDS IN NHARIRA, ZIMBABWE

Household Questionnaire

Respondent: Dairy Farmer

Interviewer:

GPS Coordinates:

- Hello. My name is Hlekani Kabiti
- I am a PHD student at the University of Venda in South Africa. As part of my studies, I am carrying out research focusing on a critical analysis of the contribution of smallholder dairy farming to the livelihoods of households in Nharira. In order to get more information about the study, I am conducting a census of households currently involved in dairy farming in this area. I would like to ask you some questions related to your household, if you are willing to participate.
- Note that the information you provide might help plan other dairy development programmes in this country and elsewhere. Reports, journal articles and policy briefs will also be generated using the information. However, specific names of people who provide the information will not be divulged against your will.
- Participation in this survey is voluntary, meaning that you can choose not to take any part in it. Should you decide to participate, note that you are free to withdraw from it at any point as the study progresses.
- If you have any questions about the survey, please feel free to ask at any point of the interview.

#### General Information

Household Identity:	Date: ...../...../.....
Ward:	Village:

## A1. Socio Demographic Characteristics

A1.1 Respondent Dairy Farmer= 1 Dairy Farmer Representative = 2	A1.2 Gender of farmer 1=M 2=F	A1.3 Age of Farmer 1= < 35 2= 36- 45 3= 46- 55 4= 56- 65 5= >65	A1.4 Marital Status 1=Married 2=Single 3=Widowed 4=Divorced	A1.5 Education 1=Primary 2=O' Level 3=A' Level 4= Tertiary 5= No education	A1.6 Employment 1= Self employment 2=Formal Employment 3= Pensioner 4= Retrenched 5= Farming	A1.7 Number of members of household 1= <3 2= 4-7 3= 8-10 4= > 10	A1.8 Number of Household members more than 15 years	A1.9 Number of Household members below 6 years	A1.10 Age of household head 1= < 35 2= 36- 45 3= 46- 55 4= 56- 65 5= >65	A1.11 Gender of household head 1=Male 2= Female

## A2 Cattle Production Enterprises

A2.1 Number of beef cattle	A2.2 Number of dairy cattle	A2.3 List Dairy breeds kept	A2.4 How best do you describe your cattle production system 1= Dairy production system 2= Mixed beef and dairy production 3= mixed crop livestock production	A2.5 How are the male calves managed? Culled at birth=1 Raised as part of the beef herd= 2 Kept for draught power =3 Sold as veal =4	A2.6 Do you practise record keeping? 1= Yes 2=No If No give reasons If so, what records do you keep?

Do you use the records for informed farming decisions: 1= Yes 2=No

## A2.6 Which of the following production practises do you carry out?

Production practise		1= Yes 2= No	Frequency of carrying out the practice (Put x or tick in appropriate box)			
			Always	Sometimes	Never	Not applicable
Which breeding method do you use in your dairy enterprise?	Artificial insemination					
	Natural service					
	A combination of natural service and artificial insemination					
Selective breeding (choosing the bull which serves the cows and heifers)						
Communal grazing (cattle feeding on communal grazing land)						
Pen Feeding (Feeding cattle whilst in the pen, using feeding troughs)						
Open feeding (Cattle freely grazing in feedlot or paddock)						
Supplementary feeding (when nutrient-rich feeds are added to the usual pastures so as to improve animal production and health)						
Accessing animal health services (Extension)						
Tethering (confining cattle within a specific area usually by tying them with a rope to a tree)						
Calf feeding: What method do you use for feeding dairy calves?	Individual					
	Group <i>ad libitum</i>					
	Group ration					
	Grazing only					
Calf weighing						
Calf suckling colostrum from dam						
Calf suckling colostrum from feeding bottles						
Parasite control	Hand spraying					
	Applying tick grease					
	Communal plunge dip					
	Pour on					

### A3. Economic practices

#### A3.1 Do you participate in any of the following agriculture-related and economic activities?

Economic activities	Do you participate in this activity? 2= No 1= Yes	Reason for carrying out the activity: 1 = Household use 2 = Marketing or sale 3 = Feed livestock 4 = Both household use and selling 5 = other (specify)	Approximately, how much do you earn from the activity per year? In US\$ 1= <100 2= 101- 200 3= 201-300 4=301-400 5= >500
Vegetable production			
Fruit production			
Field crop production			
Collection of firewood			
Collection of thatching grass			
Collection of medicinal plants			
Pastures and fodder production			
Running a local shop			
Petty trading			
Other business (specify)			

#### A3.2 Milk productivity

If records are available:

How many litres of milk did your dairy enterprise produce last year?	How many litres of milk did you sell last year?	How many litres of milk did your household consume last year?	How many litres of milk were used to feed calves?	Selling price of milk per (Litre)

### A3.3 Quantity of milk produced last year according to the month

Suppose you produced 100liters of milk last year, how would it be distributed across the months of the year?

Proportion of milk relative to total	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
a) Sold at the dairy centre?												
b) Fed to calves?												
c) Used for household consumption												
d) Given to relatives, friends or neighbours												

### A4 Background information

Answer the following questions	Response
How far is your homestead from the Nharira Dairy milk collection and processing centre? (km)	
How far is the veterinary extension office from your homestead? (km)	
How far is the communal dip tank from your homestead? (km)	
How far is the police station from your homestead? (km)	
How far is the nearest primary school from your homestead? (km)	
How far is the nearest high school from your homestead? (km)	
How far is the nearest major road from your homestead? (km)	
How far is the agricultural extension office from your homestead? (km)	

## B Contribution of smallholder dairy farming to livelihood capitals

### BI.1 Social Capital

Have you been receiving any form of dairy related support from:	1= Yes 2= No	Are you satisfied with the support? 1= Satisfied 2=Fair 3= Not sure 4= Not satisfied	State the kind of dairy related support received
Government			
NGOs			
Other Community members			
Research centres and/or universities			
External support networks (specify)			

### BI.2 Social Networks

Question	Response
How often do you participate in Nharira dairy-related meetings? 1= always 2=sometimes 3= never	
Do you receive dairy-related advice from other dairy farmers? 1= Yes 2= No	
Do you sometimes give dairy related advice to other dairy farmers? 1= Yes 2= No	
Are you a member of any dairy-related farmer association? 1= Yes 2= No	
Are you a member of the Savings and Credit Cooperative Organisation (SACCO) village bank? 1= Yes 2= No	
Have you ever borrowed money the from SACCO village bank? 1= Yes 2=No	
Do you think the establishment of the SACCO village bank can be strongly attributed to the existence of dairy farming? 1= Yes 2= No	
Do you ever lend the money you get from the dairy to other community members money when they are in need? 1= Yes 2= No	
Have you ever borrowed some money from other dairy farmers? 1= Yes 2= No	
Do you find it easy to seek help on dairy or related matters from other dairy farmers? 1= Yes 2= No	
Do you believe that other dairy farmers find it easy to seek help on dairy or related matters from you? 1= Yes 2= No	

Are you a member of a dairy-related labour network group (e.g. madzoro)? 1= Yes 2= No	
How many people do you rely on to get advice on dairy farming issues?	
How many dairy-focused community events do you attend per year?	
Have you ever had a grazing land conflict with your neighbours or other people in your area? 1= Yes 2=No	
Have you ever had conflicts with your neighbours regarding your labour network group (e.g. madzoro)? 1= Yes 2=No	
Has anyone in your neighbourhood ever complained about flies from your dairy enterprise? 1= Yes 2=No	
Has anyone ever raised any other issue relating to problems that your dairy enterprise brought to the area? 1= Yes 2=No	

### BI.3 Networks with Institutions

Farmer involvement in:	Response (1= Yes 2= No)
Breed improvement activities	
Exposure and training in artificial insemination	
Benefited from a revolving fund	
Benefited from cattle input schemes	
Benefited from the pass the heifer scheme	
Benefited from feed improvement and development programs	
Benefited from feed formulation programs and projects?	
Received training in record keeping?	
Participated in dairy farming-related research activities?	

### BI.4 Membership at the dairy

Are you a registered member of the Nharira Dairy? 1= Yes 2= No	Are you up to date with payment of monthly subscription fees? 1= Yes 2= No	Are you currently producing and selling milk? 1= Yes 2= No	Are you a registered member but not producing milk? 1= Yes 2= No	Are you a member of any dairy-related committee? 1=Yes 2=No

### B2. Physical Capital

Answer the following questions		Response
What type of transport do you use to deliver milk to the processing centre? 1= foot 2= bicycle 3= animal drawn cart 4= motor cycle 5= motor vehicle 6= other (Specify)		
How many ox-drawn carts do you own as a result of proceeds from dairy farming?		
In total, how many own ox-drawn ploughs do you own?		
Do you own a tractor as a result of proceeds from dairy? 1= Yes 2= No		
How many milking sheds do you have?		
Do you own the following milking equipment? 1= Yes 2= No	Stainless steel buckets	
	Plastic buckets	
	Tea pot	
	Other (specify)	
Do you have access to electricity from the national grid (ZESA)? 1= Yes 2= No		
Was the electricity installed using proceeds from the dairy enterprise? 1= Yes 2= No		
Do you use biogas from the dairy enterprise? 1= Yes 2= No		
Do you use solar energy? 1= Yes 2= No		
Was the solar system installed using proceeds from the dairy enterprise? 1= Yes 2= No		
Do you own an artificial insemination kit? 1= Yes 2= No		
Do you own a borehole? 1= Yes 2= No		
Was the borehole installed using proceeds from the dairy enterprise? 1= Yes 2= No		
Do you have accommodation space for your workers? 1= Yes 2= No		
Was the accommodation space built using proceeds from the dairy enterprise? 1= Yes 2= No		
What kind of toilets do you have? 1= pit toilets 2 = flush 3= No toilet		
Were the toilets built using proceeds from the dairy enterprise? 1= Yes 2= No		
Have you improved the houses at your homestead with proceeds from dairy enterprise? 1= Yes 2= No		
Do you own a house or currently building a house in other locations or town as a result of dairy? 1= Yes 2= No		

Do you own the following?		Response 1= Yes 2=No	Is it as a result of proceeds from dairy enterprise? 1=Yes 2= No
Motor vehicle			
Bicycle			
Livestock?	Beef Cattle		
	Goats		
	Chickens		
	Pig		
Have you initiated the following businesses:	Broiler chicken production?		
	Small shop?		
	Fodder and pasture sale?		
	Grinding or hammer mill?		

### B2. 2 Beef and dairy infrastructure

Infrastructure	Do you own the following infrastructure? 1= Yes 2= No	How many?	Was this constructed using any money from the dairy enterprise? 1= Yes 2= No
Dairy calf pens			
Cattle handling facilities			
Paddocks			
Separate dairy cattle kraal or pen			
Beef cattle kraal or pen			
Watering and feeding troughs			
Milking parlour or shed			
Other:			

### B3. Human Capital

#### B3. 1 Who normally carries out the following dairy farming-related chores?

\*1= Household head 2=household head spouse 3= female children 4= male children 5= Hired worker 6= Neighbour, through shared arrangements (Madzoro) 7= other (specify)

Dairy chores	*Responsible Member	Age, years 1=<15 2=16-30 3=31-65 4= 65+	Does the member carry out other agricultural related chores? 1= Yes 2= No	Did any household member receive training in carrying out the specific chores? 1= Yes 2= No	How often is the training received? 1-Always 2-Sometimes 3-Rarely	Who provided the training? 1=Extension officer 2= NGO 3 = university/ college 4 = other training providers
Procuring inputs						
Feeding dairy calves						
Feeding dairy cows						
General management of cattle e.g. maintaining and monitoring animal health						
Deworming						
Castration of males calves or bullocks						
Dipping						
Dehorning						
Weaning calves						
Cleaning and maintaining dairy cattle pens						

Milking						
Herding dairy cattle						
Transporting milk to the processing centre at Nharira Business Centre						
Artificial Insemination/ Breed improvement						
Growing fodder crops						
Making silage						
Mixing feed before feeding cattle						
Treating maize stover with urea						
Constructing cattle pens						
Maintaining cattle pens						
						<b>Response</b>
How many members of your household provide labour for dairy farming?						
Is there an increased demand for labour as a result of dairy enterprise? 1= Yes 2=No						
Do you have longer working hours as a result of your involvement in dairy farming? 1= Yes 2=No						
Do you lack leisure time due to the labour demand associated with the dairy enterprise? 1= Yes 2=No						
How many of your dairy cows are owned by individuals less than 35 years old?						

### B3.2 Agricultural training

Did you or any member of your household received the following training in agriculture?

Training	Response (1= Yes 2= No)
Master Farmer	
Advanced Master farmer	
Degree in livestock science	
Diploma in agriculture	
Certificate in agriculture	
Short or refresher courses in dairy production and management	
Other training in agriculture (specify)	
None	

**B3.3**

Answer the following question	Response
How many members of your household have fallen sick and failed to go to the clinic or hospital as a result of a sickness related to dairy enterprise?	
Has any member of your household have ever fallen sick as a result of a disease spread by flies? 1= Yes 2=No	
Has any of your children fallen sick due to nutrition related disease after you started practising dairy farming? 1= Yes 2=No	
How many members of your household relied on income from the dairy enterprise for their tertiary education and training?	
How many members of your household relied on income from the dairy enterprise for their primary and secondary education?	
Has any member of your household ever drop out of school as a result of the demands of the dairy farming? 1= Yes 2=No	
How many members of your household are now in long-term or short-term employment mainly due to the introduction of smallholder dairy farming?	
For how long (in years) have you been a member of the Nharira Dairy scheme?	

For how long have you been involved in dairy farming?	
Do you use sometimes go on holiday with proceeds from dairy enterprise? 1= Yes 2=No	
Do you afford to buy nutritious food using proceeds from dairy enterprise to buy? 1= Yes 2=No	
Do you afford to buy good clothing for all household members with proceeds from dairy? 1= Yes 2=No	

#### B4. Natural Capital

Land ownership, water sources and energy development	Response
What is the total size of land that you own (In hectares)?	
What is the size of the land which you use for grazing (In hectares)?	
What is the size of land used for pasture production (In hectares)?	
What is the size of land used for arable crop production (In hectares)?	
Do you water some or all the crops you grow? 1= Yes 2= No	
Do you water dairy pastures? 1= Yes 2= No	
Do you have private grazing land? 1=Yes 2=No	
Do you have fodder trees around your house which also serve as wind break? 1= Yes 2=No	
Do you apply dairy cattle manure to improve soil fertility? 1= Yes 2=No	
Where do you get water for your animals? 1=borehole water 2= river 3= own water well at the homestead 4= communal water well in the locality 5 = reservoir/dam 6= other(specify)	
Where do you get water for domestic use? 1=borehole water 2= river 3= own water well in or close to our yard 4= communal water well in the locality 5 = reservoir/dam 6= other(specify)	
Do you own a borehole? 1= Yes 2= No	
Which of the following energy sources do you use: 1=Solar energy 2=Grid energy (magenta)	Cooking
	Lighting
	Electrical gadgets

3= Biogas energy 4= Firewood 5= Other (specify)	Charging phone	
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## B5. Financial Capital

### B5.1

Income and remittance	Response
On average, how much do you get from dairy farming per month? ( US\$)	
How much non-agricultural related income do you get per month?	
Do you receive any remittances from family members? 1= Yes 2= No	
Do you send any remittances to any of your relatives? 1= Yes 2=No	
Are you a member of formal or informal saving scheme using proceeds from dairy farming? 1= Yes 2= No	
Are you paying debt related to dairy farming? 1= Yes 2= No	
Are you paying any other debt not related to dairy farming using money from dairy enterprise? 1= Yes 2= No	
Did you get any credit in the previous 5 years? 1= Yes 2= No	
Do you have a better chance of accessing credits as a result of dairy enterprise? 1= Yes 2= No	
Do you sometimes sell the manure from dairy cows? 1= Yes 2=No	
Have you ever sold your heifers to get income? 1= Yes 2=No	
Have you ever sold your dairy cows? 1= Yes 2=No	
Have you ever sold your dairy bulls? 1= Yes 2=No	
Have you ever sold your dairy calves? 1= Yes 2=No	
Do you have a bank account to save mainly the income from the dairy enterprise? 1= Yes 2=No	
Do you use your dairy cattle for any form of barter trade? 1= Yes 2=No 3= Rarely	
Do you have insurance policies which you pay using income from dairy farming? 1= Yes 2=No	

## B5.2

How much do you spend on the following per month (US\$)	US\$
Dairy cow feed	
Animal health-related expenses	
Transportation of milk	
Hired labour	
Maintaining dairy cattle pens	
Other expenses (specify)	

## C. Challenges faced

Are you facing the following challenges? 1= Yes 2=No

High cost of feeds, which reduce your profits	
Serious competition for time between dairy farming and other farm and non-farm activities?	
Lack of knowledge of dairy farming	
Lack of markets for milk	
Spoilage of milk resulting in it being condemned or downgraded at the Dairy Centre?	
Lack of information on how to expand the dairy enterprise	
High incidences of cattle diseases	
Poor management of the dairy cooperative	
Conflicts associated with communal grazing area due to jealous neighbours?	
Inappropriate milk handling skills	
Inadequate water for dairy cattle	
Low milk prices yet costs of running the dairy enterprise are worsening?	

Milk spoilage due to high temperatures	
Milk spoilage due to various transportation-related challenges	
Use of poor or inappropriate dairy breeds because of inadequate supply	
Use of poor or inappropriate dairy breeds because of inadequate funds to purchase the recommended ones	
A lot of houseflies in the home due to cattle manure accumulation in pens and also close to the homestead	
Other (specify):	

Appendix 10: Research Policy Brief

## IRD Policy



University of Venda

Institute for Rural Development

### IRD Policy Brief

Year: 2017

Issue No: 1

#### Vision

To become a leading university-based player in combating poverty and rural underdevelopment in Southern Africa

#### Mission

The Institute for Rural Development (IRD) applies people-centered action research principles, and innovative teaching and learning methods in its quest to provide effective leadership in finding appropriate solutions to the multiple and complex poverty-related challenges of communities in rural areas of Southern Africa.

#### Strategic Goals

- 1) To combat poverty and rural underdevelopment through implementing long-term community-based programmes;
- 2) To enhance research and innovation for rural development;
- 3) To promote quality facilitation of teaching and learning in postgraduate training and need-based short courses for rural development; and
- 4) To establish viable linkages and strategic partnerships for combating poverty and rural underdevelopment.

**Title of research:** **Contribution of Smallholder Dairy Farming to Livelihoods of Households: The Case of Nharira, Zimbabwe**

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## **1. Executive Summary**

Over the years the government of Zimbabwe has been supporting the setup of smallholder dairy farming schemes across the rural areas of the country. This was done in order to address poverty and malnutrition challenges in rural settings. Even though such a policy has been implemented since the early 90s, there is no comprehensive evidence on how participation in such a program affects household welfare. This policy brief highlights the value and cost accruing to the households participating in smallholder dairy in Nharira, Zimbabwe, in order to make recommendations on future policy pathway.

The policy recommendations delivered in this brief are an outcome of an empirical study on the contribution of smallholder dairy farming to livelihood capitals of households in Nharira, Zimbabwe. The key aim of the study was to identify the positive and negative contribution of smallholder dairy farming, as a livelihood strategy, on household human, social, physical, financial and natural capital portfolio. Findings from the study are discussed as a means to draw out policy recommendations. Study findings confirm that households participating in smallholder dairy farming in Nharira have livelihood capital benefits accruing to them though there are issues which need to be addressed. Study findings implicate smallholder dairy farming as a viable household livelihood option and pathway to achieving the sustainable development goals within the rural setting. Key recommendations are as follows:

- a) Continual support and establishment of smallholder dairy farming schemes;
- b) Targeted support and incentivisation of youth participation in dairy farming and entrepreneurship;
- c) Extension services to work with farmers with regards to appropriate herd sizes per household in the area; and
- d) More farmer-to-farmer visits should be encouraged to enable peer motivation in the application of acquired knowledge into practice.

## 2. Background/Context

Smallholder dairy farming provides a vital source of livelihoods for rural households across the globe (FAO, 2016). As has been the case in Eastern and Southern Africa, Zimbabwe continues to regard smallholder dairy farming as a viable strategy for addressing poverty and malnutrition, especially in rural areas. This was and still is achieved through the Dairy Development Programme (DDP), whereby the government funds for the establishment of milk processing and marketing infrastructure which is handed over to the smallholder dairy farmers (Munangi, 2007). The farmers then organise themselves along the cooperative line in order to utilise the facility. Production is carried out individually. However, the farmers pool their produce for processing and marketing. Initially, the program started off with 13 smallholder dairy schemes which have since grown to 30 to date. Nharira dairy farming scheme was one of the initial projects which is still running.

Although, the country has since the early 1980s been promoting the introduction of smallholder dairy farming, the nature and extent of changes in livelihoods (human, social, physical and financial capitals) within participating households was unclear. Such knowledge provides a comprehensive picture on the livelihood changes which accrue as a result of dairy farming. Having such information is vital to the smallholder farmers as they will be more aware of the livelihood repercussions as a result of dairy farming. Consequently, this policy brief is based on a study carried out to unpack the contribution of smallholder dairy farming towards the livelihoods of households in the Nharira dairy scheme of Zimbabwe. The study applied the Department for International Development sustainable livelihoods framework (DfID, 2000) to build the understanding on livelihood capital derived from smallholder dairy farming.

## 3. Study Approach

Information which guided this policy brief was originated through a two stage data collection process. Data was collected from 21 farmers participating in smallholder dairy farming in Nharira. The first stage was exploratory. The farmers were engaged through participatory mapping and focus group discussion. The outcomes were grouped according to themes and used to inform the crafting of the household questionnaire which was used for the second phase. Descriptive statistics and household capital indices were formulated to measure the extent to which smallholder dairy farming contributes to livelihoods. The extent of contribution of smallholder dairy farming to livelihoods was measured by the indices which ranged from 0 to 1.

#### 4. Study Findings

**Table 1: Livelihood capital indices for households in Nharira**

Index of capital	Mean	Minimum	Maximum
<b>Physical</b>	0.47	0.29	0.73
<b>Human</b>	0.48	0.38	0.62
<b>Financial</b>	0.49	0.15	0.83
<b>Natural</b>	0.52	0.10	0.82
<b>Social</b>	0.59	0.26	0.95
<b>Livelihood</b>	0.51	0.31	0.69

The study results revealed that households participating in smallholder dairy farming experience increased livelihood capital benefits as shown in Table 1. In general, smallholder dairy farming enhances all livelihood capitals of households participating in smallholder farming. The degree of contribution is almost the same across all the livelihood capitals. However, social capital has the highest index value (0.59) as compared to the rest of the capitals as shown in Table 1. Even though quantitative results highlighted an overall positive contribution, a few negative aspects were highlighted during the focus group discussions. Smallholder dairy was found to cause tensions between the farmers and non-farming group due to jealous, and conflicts related to grazing land and working arrangements. Rural settings are known for strong social capital base. The additional social capital brought by smallholder dairy farming is vital for the sustainability of livelihoods. Rural development programs need to take advantage of the abundant social capital and find ways to divert it into meaningful livelihood strategies. In addition, rural development initiatives should be designed in ways which avoid tensions amongst participants.

Smallholder dairy farming had an overall positive contribution to human capital. This is mainly due to the various training programs and workshops which the farmers participate in. Additionally, the farmers were able to send their children to school as a result of dairy farming. However, the farmers acknowledged the labour intensive nature of the enterprise. Furthermore, only 2 of the 21 farmers were under the youth category, and thus, poses a sustainability challenge. Rural development policies or strategies encompassing smallholder dairy farmers need not to be labour intensive. This will enable the farmers to participate in diverse livelihood strategies despite the high labour demanding nature of dairy farming. In addition, there is need for efficient, effective and sustainable utilisation of hired labour in a way that other livelihood strategies benefit beyond dairy farming. Hired labour can be used for other enterprises or livelihood options. Considering that a lot of ground has been covered on training related to dairy farming yet problems still exist with regards to record keeping, it is vital to design training objectives with the trainees so as to ensure that they are willing to implement the learnt practises. Smallholder dairy farming has potential to provide rural employment on farm and off farm.

Smallholder dairy farming can be used as a strategy for human development in rural settings through improved education, employment and nutrition

Physical capital benefit the least from smallholder dairy farming. Nevertheless the positive benefit is still important to household welfare and rural development. Use of biogas which is a clean source of energy, can be encouraged even to rural households who rear cattle for other purposes. This can play a huge role in solving the issue of deforestation. Due to the hygienic requirements for participation in dairy farming scheme; farmers are more likely to invest in setting up a secure water source. This contributes to access to safe drinking water in rural areas. Furthermore, smallholder dairy farming can potentially enhance quality of housing and improvement of sanitation in rural areas of Zimbabwe. Dairy farming can be used as a strategy in rural settings to enhance household ownership of assets, access to clean water, energy and sanitation and in the process contributing towards attainment of all Sustainable Development Goals (FAO, 2016). Thus, smallholder dairy farming can be used to improve the quality of life for rural livelihoods.

Smallholder dairy farming was also found to contribute positively to natural capital through provision of manure for production of biogas, enriching agricultural land and enhancing access to clean underground water source. Consequently, smallholder dairy farming can be used for enhancement of natural resources in rural setting. However, this can be fully achieved if overstocking issues are addressed. Farmers need to be better informed on the impacts of over stocking and how it can affect their operations in future.

Of importance is the contribution of dairy farming to financial capital. Smallholder dairy farming also provides a pathway for enhancing access to both formal and informal financial institutions. Increased financial capital produces multiplier effects which enhances household self-sufficiency and access to other needs. Rural development programs which seek to address the cash income challenges need to consider smallholder dairy farming as an option. However, this is only achievable if marketing structures are put in place as is with the case of Nharira dairy. This further reduces reliance on external funding and support from NGOs and government. It is vital for farmers to plan their production trends so as to ensure that they produce the milk throughout the year so as to keep the stream of money flowing.

Household livelihood capital index was computed as an average of the five livelihood capital index scores for each household. Of interest is the fact that a household participating in smallholder dairy farming had an average livelihood capital index value of 0.51 with a minimum score of 0.31 and a maximum score of 0.69 (Table 1). Households participating in smallholder dairy farming in Nharira fall under the medium livelihood capital index. This results suggest that a household can survive fairly well on smallholder dairy farming and can potentially diversify into other livelihood options.

The findings of the current study suggest that smallholder dairy farming is a viable livelihood strategy for households residing in the rural areas. Its strength lies in its ability to enhance all the livelihood capitals of the participating households. Livelihood capital ownership by a household enable diversification into other options, enhance household resilience and reduce vulnerability to shocks and risks. These findings imply that smallholder dairy farming can be encouraged as a tool for enhancing household livelihood capital for rural development. Nevertheless, this should be done through careful planning, in collaboration with the farmers so as to properly manage the workload and grazing capacities.

In order to better understand the relationship among the livelihood capitals, a correlation test was carried out. Results indicated that all the livelihood capitals are positively associated with each other at varying strengths though. Social and financial capital have the strongest association of all the livelihood capital (0.666). Social capital also has a moderate and positive association (0.504) with human capital. Same results were also observed for natural and physical capital with a correlation value of 0.449. This implies that enhancing one of the capitals can positively affect the other and vice versa. Such observations imply that changing the contribution of smallholder dairy farming towards social capital will result in a change in financial and human capital. Consequently, social capital occupies a key position among the rest of the capitals. This observation is important for rural development practise where programs can be designed to enhance social capital benefits from dairy farming. This will in turn result in the improvement of human capital and financial capital. Relationship between natural and physical capital can also be viewed in the same way.

The rest of the capital combinations had low correlation scores (between 0.0089 and 0.398). However, the low correlation score is an indicator that the capitals are related through the he associations are not strong. Positive correlations across the livelihood capitals signifies the inter relatedness of the livelihood capital assets benefits from dairy farming.

## 5. Policy Recommendations

- a) Policies should be put in place to continue supporting and encouraging smallholder dairy farming schemes. Establishment of dairy farming schemes in rural areas should be promoted. Such a policy will go a long way in improving the farmer's productivity and livelihoods at the same time. This should, however, be done together with other livelihood strategies so as to ensure comprehensive sustainable package of benefits to households and reduction of risk.
- b) There is need to support youth involvement in dairy farming, particularly as a way of enhancing youth participation in dairy farming and agriculture. The Government departments working with youth can consider using smallholder dairy farming as a livelihood strategy for young people who have access to land and reside in rural areas. The program might include incentivizing youth participation through targeted aid and training for dairy entrepreneurship.
- c) There is need for extension services to work with farmers with regards to appropriate herd sizes which can be kept. This can help to reduce the pressure on grazing land

thereby reducing conflicts and environmental degradation. Farmers can also be encouraged to intensify feeding practises so as to ensure that the cows kept for dairy are pen fed instead of being let out to the communal grazing lands.

- d) More farmer-to-farmer visits should be encouraged to enable peer motivation in the application of acquired knowledge into practice. This will play a significant role in bringing the gap between knowledge acquisition and its application.

## 6. Limitations of the Study

The study was based on the case of Nharira which limits the applicability of the recommendations on a wider scope. As such, we recommend that further similar studies to be carried out with a wider scope so as to better inform the situation at national level. In addition, a study addressing targeting improvement of efficiency and labour productivity is recommended. This would provide answers to the challenges of taxing work associated with dairy farming.

## 7. References

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## 8. Acknowledgements

This policy brief is based on a study that was funded by the University of Venda Research and Publication Committee (RPC) (SARDF/12/1EC/0). We thank the Nharira Dairy scheme farmers for providing data for the study.