Analysis of food value chains in smallholder crop and livestock enterprises in Eastern Cape Province of South Africa.

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200910040

Submitted In Fulfillment of the Requirements for the Degree of

Master of Science in Agricultural Economics

Department of Agricultural Economics and Extension

Faculty of Science and Agriculture

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April 2011

DECLARATION

I, Binganidzo Muchara, hereby declare that the work contained in this thesis is my own and that other scholars' work referred to here have been duly acknowledged. I also declare that this thesis is original and has not been submitted elsewhere for a degree.

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Binganidzo Muchara Date

ABSTRACT

The study was conducted in Mbozi and Ciko villages in Mbhashe Local Municipality of the Eastern Cape Province of South Africa. Two irrigation projects in the area were studied. Consumers and agricultural commodity traders in Willowvale Town, Dutywa, Butterworth and East London were also interviewed. The major objective of the study is to profile and map cabbage, maize and cattle food value chains broadly, and to understand their nature, constraints and opportunities in smallholder agriculture.

A multi-stage random sampling procedure was used in which the first stage involved selecting the local government areas. This was followed by the selection of the district and then the respondents. A total of 168 participants were sampled in the proportion of 82 smallholder farmers, 41 consumers, 26 hawkers and 20 agricultural commodity traders. Focus group discussions and key informant interviews were also used during the data collection process. Value Chain mapping was done using the commodity based approach. All value chains under study indicated that they are short and commodities were transacted in unprocessed form. As cabbages and maize move from the farm to retail outlets, value addition start to take place through transportation to the market and processing in supermarkets. The cattle value chain however does not have a forward linkage beyond the two administrative boundaries of the two communities. Less than 3% of the farmers traded livestock, and this was mostly through private sales to neighbours. The farmers' major goal in agricultural production is assumed to be an important aspect in lengthening the value chain. As such, results of a Pearson's correlation exercise indicated that there is a significant relationship at 0.05% level between goals of the farmers and the village of origin. Some factors that showed significance ($p=0.05$) in influencing farmers' goals are membership of an irrigation project and household sources of income.

An analysis of determinants of technical efficiency at farm level was performed using the stochastic frontier model for cabbage, maize and cattle enterprises. The results showed that rainfall adequacy, input costs, market channels and quantity sold are important determinants of cabbage production efficiency. On the other hand, maize production efficiency is positively determined by market price, area under production and rainfall adequacy. Market related variables are major drivers of the cattle value chain efficiency and these include cattle prices, market satisfaction, market channel and farm labour.

Key Words: Food Value Chain, Commodity Based Approach, Stochastic Frontier Analysis, Technical Efficiency, Smallholder Farmer

ACKNOWLEDGEMENTS

The project is part of the boarder Water Research Commission Project number K5/1879/4 (2009 – 2014), that seeks to analyse food value chains in rain-fed and irrigated agriculture to include emerging farmers in the mainstream of the economy. As such, much information in the project is also contained in some specific deliverable reports submitted to Water Research Commission between 2009 and 2010 through the Institute of Natural Resources (INR) in KwaZulu-Natal and ARDRI (University of Fort Hare).

During the course of the project, a number of people made important contributions through advice and encouragement. My first and foremost thanks go to my supervisor, Prof A Obi for his tireless efforts and guidance from the inception of this project up to its completion. Prof Obi, I thank you for the welcome gesture that you extended to me on my arrival at University of Fort in March 2009. Thank you for your patience and constructive sources of ideas and resources that kept me motivated and made the completion of this project possible. I gratefully acknowledge Water Research Commission for full funding of the project through ARDRI (Agricultural Rural Development Research Institute –University of Fort Hare) and the Institute of Natural Resources (INR). Specifically, I want to thank Prof PJ Masika (Director of ARDRI) for incorporating me within your research team and guiding me throughout the research. Thank you for all support functions like vehicles, telephones, stationery and finances that have managed to keep my moral high. Your effort in reviewing my work is as well appreciated. Brigid Letty (Institute of Natural Resources), I thank you for all the funding, reviews and input on data collection and final reports. I also want to thank Dr V Maphosa for your effort in language translation and driving the team during data collection.

Dr Mkeni (AGRIPARK), I thank you very much for your expertise and guidance on cabbage value chains. May your knowledge continue to inspire more academics and professionals. My team of enumerators that include post graduate students of the department; Melusi Sibanda, Thulani Magida, Bongiwe Mcata, Portia Ndou, Nothombeko Mbusi and Kgothatso Thamaga, I thank you for sacrificing your school work to help me out. You braved the bad rainy weather during the data collection period. Keep up the team spirit. Colleagues and classmates and all post graduate students in Agricultural Economics and Extension, I thank you for your inputs during presentations and analysis of results. Members of Ciko and Foundation Community project, through the project leaders Mr V Maposela and Mrs Ntintili, I thank you for your cooperation and support during the data

collection process. I also thank the extension officer of the area Miss Lindiswa Mgoqi for the help and support during data collection.

My family; I thank you for sacrificing the little resources we have to educate me. Almighty God, thank you for making my dream come true. I will always give praise and worship unto you.

Thank you.

DEDICATION

To Tari and Nicole

LIST OF ABBREVIATIONS AND ACRONYMS

ARC	Agricultural Research Council
ARDRI	Agricultural and Rural Development Research Institute
CGE	Computable General Equilibrium Model
CSF	Critical Success Factors
DEA	Data Envelopment Analysis
DMU	Decision Making Units
DWAF	Department of Water and Forestry Affairs
ECDC	Eastern Cape Development Corporation
FAO	Food and Agriculture Organization of the United Nations
GCCA	Global Commodity Chain Analysis
ICRA	International Center for Research in Agriculture
INR	Institute of Natural Resources
IRWH	Infield Rain Water Harvesting
LWP	Livestock Water Productivity
NERPO	National Emergent Red Meat Producers Organisation
NDA	National Department of Agriculture
NAMC	National Agricultural Marketing Council
SAB	South African Breweries
SFA	Stochastic Frontier Analysis
SPSS	Statistical Package for Social Scientists
USAID	United States Agency for International Development
VCA	Value Chain Analysis
WRC	Water Research Commission
WUA	Water User Association

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CHAPTER 1

INTRODUCTION

1.1 Background

The most serious constraint to small farm production relates to problems of access to production resources, which include inputs like water, power, fertilizers, feeds, capital, extension services, and information as well as access to markets (Minot, 1993). Where production targets are met, farmers are often confronted with high transactions costs, sub-standard grades and poor prices that are discouraging to farmers. Very short value chains often characterize the smallholder farmer, whose raw and fresh products are sold at the farm gate with very minimal value addition. The implications for such short chains are small portions of agricultural value as well as low household incomes.

Smallholder farmers often lack the production and marketing information necessary to enhance their competitiveness (Alternburg, 2007). Alternburg (2007), realised that even with sufficient knowledge regarding profitability of intended investments, smallholder farmers often lack the financial reserves to implement their decisions, where external credit is limited by lack of collateral. Scandizzo, Hazell and Anderson (1984) also argued that smallholder farmers operating near subsistence level are more risk averse than larger farmers leading to unreliable supplies by subsistence farmers.

Many developing countries are facing challenges of low output and productivity, characterized by inefficient marketing support structures and constrained input supply patterns (Alternburg, 2007). There are sharp differences of opinion as to the relative importance of the various factors that have contributed to the slowdown in productivity growth in many parts of Africa and Asia. For instance, there is a general optimistic growth perspective based on a judgment that slowdowns in growth of production and appropriate responses to changes is in relation to prices and government reforms, and that growth in food grain production can be sustained through normal technological improvements (Anderson,1994). According to this assertion, the increased rates of productivity growth in India and Bangladesh and in regions within countries with aggregate growth slowdowns indicate the continued existence of exploitable yield gaps with existing agricultural technology.

Minot (1993) argues that several factors including product price changes will continue to induce fine-tuning of agricultural technology even in intensively cropped areas, which will result in productivity growth. Such response is very critical especially considering its effect on the overall performance of

a product value chain. Productivity growth due to technology or product price changes does not only affect crop value chains, but also positively affects production, where output and quality of products is expected to increase with improvement in technology and market prices (Kaplinsky and Morris, 2000). However, the overall critical success factors, generally referred to as the main drivers of food value chains, need scrutiny and effective understanding to come up with informed decision as to their effect on the performance of the whole value chain (Kaplinsky and Morris, 2000).

The issue of production efficiency has set high benchmark standards for successfully penetrating both domestic and global markets for sustained income growth. The notion of production efficiency allows us to pay attention to production related issues, in relation to how inputs are channeled into the production process to deliver output in ways that enhance household welfare and livelihoods. This has actually prompted researchers to adopt value chain analysis as a way to improve efficiency at all stages of production, with a focus resource usage.

A systematic food value chain analysis is important to understand all the factors at play including institutional and technical relationships which facilitate emerging farmers' capacity to increase output and efficiency as well as eliminating the uncertainties in marketing their output. In a bid to include both subsistence and emerging farmers in the mainstream of the economy, the study focuses on production and marketing trends in both rain fed and irrigation farming systems as practiced in two villages of Mbashe local Municipality of the Eastern Cape Province, South Africa.

1.2 Problem statement

Eastern Cape Province has high poverty levels in South Africa, where Amatole District has as high as 72% of its population living in poverty and 96% of the economically active population are un-employed (ECDA, 2006). The government of South Africa initiated several programmes post-apartheid in 1994, aimed at addressing colonial injustices and improving rural livelihoods. However, very minimal success has been recorded due to a wide range of factors ranging from technical, social, political and economic factors. The South African government also has policies that are meant to integrate black smallholder farmers in the mainstream agricultural economy in line with the Millennium Development Goals aimed at halving poverty by 2014. Such policies include the Agriculture Black Economic Empowerment (Agri-BEE) and Land reform programme, which are meant to improve land accessibility by historically disadvantaged individuals. To those with access to land, provincial agricultural programmes were rolled out such as the Massive Food Programme,

Green Revolution, Siyazodla Food Production and Siyakhula Food Production programme. All these programmes are aimed at ensuring food security among the poor. It is however important to understand the environment that the South African government is operating in, which is characterised by water shortage, climate change and economic recession. The recent escalation of food prices and financial meltdown even created a sense of urgency previously unknown.

Small-scale producers and producers' organizations today face a set of challenges brought about by the unprecedented changes in modern markets. Their capacity to participate, compete or adapt is influenced by a complex set of interacting and diverse factors, which includes the broad spectrum of capital assets such as human, social, organization, physical and financial capital. At the same time developing economies demand extensive inclusion of smallholder outputs to ensure economic growth to sustain the ever increasing demand for food, employment, health care and education. Exploration of smallholder farmer capabilities through research to promote integration of subsistence and emergent farming in food value chains for crop and animal products is still limited in developing countries. Productivity among smallholder farmers with regard to output, resource accessibility and utilization is also very low. There is therefore need for a thorough assessment of farmers' aspirations, technical capabilities, risks of crop and livestock production, output price expectations and incentives to increase productivity as a way of influencing the decision on what value chain to enter, and the degree of success obtained by smallholder farmers.

Smallholder farmers are perceived to be deriving low value from agricultural outputs in South Africa. This is assumed to be caused by the weak participation of smallholder and emerging farmers in high value formal markers. The study seeks to explore the gap between the different value chains on the demand side, where consumers demand food in different marketing outlets, and the supply side with a large number of rural inhabitants, which include subsistence, emerging and commercial farmers, who can potentially respond and enter any one or a combination of commodity value chains.

1.3 Research objectives

1.3.1Main objective

The main objective of the study is to analyse agricultural food value chains from farm-level to final consumption, as a basis for gaining insights into how subsistence and emerging farmers can be integrated into the mainstream agricultural economy of South Africa

More specifically, the research aims to:

1. assess the needs and aspirations of smallholder farmers in agricultural commodity chains
2. profile and map food systems broadly to understand their nature, constraints and opportunities in smallholder rain-fed and irrigated agriculture.
3. assess the production efficiency at farm-level in respect of the predominant commodity groups and enterprises in the farming system

1.3.2 Research questions

The study is guided by the following operational questions:

1. Do farmers' needs and aspirations affect their subsequent participation in agricultural commodity value chains?
2. What is the nature of food value chains in smallholder farming sector.
3. What are the determinants of smallholder technical efficiency at farm level in terms of resource use?

1.4 Hypothesis

In order to achieve the general objective of the study, the following specific hypothesis was tested:

1. Farmers' needs and aspirations affect the nature and type of value chains they participate in.
2. Smallholder farmers' food value chains are characteristically short with limited market players.
3. Smallholder value chains are not technically efficient in terms of resource use.

1.4 Justification of research

The study relies on Porter's argument that the significance of value chain analysis is to enhance understanding of farm value chains to better design improvements to farm conditions and farmer welfare (Porter, 1998). Due to rapid globalization and accelerated industrialization, value chain analysis has become increasingly important. With the growing division of labour and the global dispersion of the production components, systemic competitiveness cannot be ignored (Kaplinsky and Morris, 2000). This has led to specialisation and at a micro level means that workers do not waste time picking up and putting down their work-in-progress, and allow them to concentrate on developing their specific skills (Kaplinsky and Morris, 2000).The project seeks to resolve the challenge of maintaining the productive capacity in agriculture and at the same time utilising the opportunity for subsistence farming to produce more in response to current food shortages and higher food prices. This research contributes towards profiling smallholder performance and identifying ways that can be explored to incorporate farmers into formal markets and enabling them to contribute to the economy.

1.5 Research outline

The study comprises six chapters. The first chapter gives an introduction to the research wherein the context, the problem addressed and the objectives of the study are discussed. A detailed presentation of literature value chain analysis and value chain methodologies are given in chapter two of the study. Chapter three presents the theoretical and analytical framework, wherein the methodology used in the study is explained. In this chapter an overview of the study area is also given, with emphasis on the selection process, physical characteristics and its relationship with surrounding areas. This chapter also outlines how the theory is applied in the present study. The results of the study are presented in three chapters namely; chapter four, five and six. Profiling of the farmers' demographics as well as their needs and aspirations in food value chains is covered in chapter four. Chapter five presents a detailed investigation and mapping of cabbage, maize and cattle value chains. Quantitative results on smallholder production efficiency for maize, cabbage and cattle value chains are presented and discussed in chapter six. The final chapter (seven) presents a summary of the research findings, conclusions and the recommendations followed by a list of references and appendices at the end of the thesis.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The purpose of the study is to investigate the production and marketing environment in which the subsistence and emerging farmers are operating, in order to identify mechanisms and interventions that will assist them to enter the mainstream economy and formal markets. The literature review examines the concept of value chain in food systems and their implications for livelihoods. The review highlights the gradual transition of the value chain concept from earlier focus on industrial and organizational studies and its subsequent application in the agricultural sector. The review chapter is divided into three main sections that include (i) a review of the value chain concept and its application in agriculture (ii) the review of the water resource use in agricultural value chains for both crop and livestock production and (iii) a review of the value chain methodologies.

The aim of the literature review is to highlight some of the previous work done to date on smallholder agriculture and food value chains in South Africa and globally. The review also explores the techniques (methodologies) and parameters (variables) that are required or that have been used in carrying out value chain analyses studies. Qualitative and quantitative value chain analysis methodologies are also reviewed in this section. The chapter concludes with a review case studies and an overview of the benefits of value analyses in agriculture.

2.2 The origin of "Chains" as systems

As viewed by Michael Porter (1985), value chains originate from the notion of a system as a set of interacting and interconnected activities within a commodity cycle. Porter (1990) compliments the intra-link functions with the concept of the multi-linked value chain, which he refers to as the value system. Later, Da Silva and Filho (2007) defined a system as a set of components and networks with functional relationships. The system components interact through dynamic links that involve the exchange of information to reach an objective (Da Silva and Filho, 2007). Economists have been concerned with the ways in which individual sectors are organized and perform. Research work in the area of industrial organization has offered the theoretical and analytical background that inspired much of the work about value chains (Da Silva and Filho, 2007). From a historical perspective, the

consideration of agri-food chains as systems is a result of the gradual development of methods and approaches to analyse economic sectors (Da Silva and Filho, 2007).

Industrial organization studies focused on the sector or industry as a collection of firms producing similar products for similar markets (Porter, 1998). As such, the structure of the industry in terms of number of firms, their market shares, the relative ease of entry and exit was related to the conduct of the firms (long-term strategies, pricing policies, investments in research and development, advertising) that would in turn define their performance (Da Silva and Filho, 2007).

The timeline on Table 2.1 gives an evolution understanding of the value chain concept, as it evolved through time across varied disciplinary fields, areas of application and levels or scale of analysis.

Table 2. 1: The evolution of the value-chain concept

Period	Concept/Paradigms	Major Disciplines and focus
'50s	• Input/output Analysis	Economics, Engineering, Management Science, Operations Research
	• Agribusiness (Harvard)	Economics. Business Management
	• Industrial Dynamics & Systems Science (MIT)	Economics, Engineering, Management Science, Operations Research
'60 and '70s	• Industrial Organisation	Economics
	• Subsector Analysis (Commodity Systems Approach)	Economics
	• French 'Filiere'	Economics, Business Management
'80s	• Porter's value chain (1985)	Business Management
	• Supply Chain Management	Business management, Engineering, Management Science, Operations Research
'90s	• Agro food chains; agro-industrial chains etc	Economics, Business management, Engineering, Management Science, Operations Research
	• Global Commodity Chains	Economics
	• Policy Analysis Matrix (PAM)	Economics
2000s	• Global Value Chains (Revisited)	Economics, Business management, Engineering, Management Science, Operations Research

Source: Adapted from Da Silva and Filho, (2007).

There is a common understanding that all concepts summarised on Table 2.1 define all stages from production to consumption as well as waste utilisation of the product in question. Earlier chains dwelt

more on manufacturing industries, and the modern value concept has since widened to cover primary agricultural production and its associated industries. Value chain analysis is sometimes used interchangeably with subsector analysis (Bekele and Hailemarian, 2007). According to Bekele and Hailemarian (2007), while a subsector analysis examines all the firms, channels and markets related to a specific product or service, whole value chain analysis focuses on a single vertical chain of firms leading to a particular consumer market. Value chain analyses often include additional analytical elements beyond subsector analysis such as inter-firm cooperation, governance and geographic coverage that extends to global markets (Bekele and Hailemarian, 2007).

2.2.1 Defining the concept of a food value chain

A value chain can be defined as the full range of activities which are required to bring a product or service from conception, through the different phases of production involving a combination of physical transformation and the input of various producer services, delivery to final customers and final disposal after use (Porter, 1985; Kaplinsky et al, 2000; Hellin et al, 2006). Traditionally, the value chain concept has been defined using the concept of the firm (Porter, 1998), where a firm refers to a collection of activities that are performed to design, produce, market, deliver and support its product (Porter, 1998).

According to Porter (1985), value activities are divided into two broad types, primary activities and support activities. Primary activities are the activities that include the creating of a product, marketing, delivering the product to buyers, as well as after-sales assistance/service. Primary activities are classified into five categories which include inbound logistics (activities associated with receiving, storing and disseminating inputs to the product); operations (activities associated with transforming inputs into the final product); outbound logistics (activities associated with distribution); marketing and sales (activities associated with providing a means by which buyers can purchase a specific product) and service (activities associated with providing services to enhance value of the product) (Porter, 1985). Support activities underpin the primary activities and each other by exchanging inputs. On the other hand, Porter (1985) defined support activities as classified into four categories, namely procurement, technology development, human resource management and firm infrastructure. Support services are important to ensure that primary activities operate efficiently.

According to Porter (1998) the concept of value chains can used to identify barriers to entry at each point along the chain as well as 'economic rent' along the chain. Players along a particular food value chain find ways to innovate in order to increase their 'rent' and their profits (Kaplinsky and Morris, 2000).

Porter (1998) argues that although firms in the same industry may have similar chains, the value chains of competitors often differ and differences among competitor value chains are a key source of competitive advantage. A firm's value chain may vary for different items in its product line, different buyers, geographic areas, or distributional channels (Porter, 1998).

Some authors make use of identical notions to food value chains, such as supply chains, production chains, or commodity chains (Porter, 1998). There are direct similarities and overlap between these different concepts although their focus may be different. Value chains integrate supply chain activities, from determination of customer needs through product or service development, production / operations and distribution (Altenburg, 2007).

2.2.2 Value Chain Linkages

Value chain linkage can be defined as the interconnectedness of value chain activities from the input side through to production and consumption (Gerrefi, 1994). The activities that comprise a value chain may be contained within a single producer (firm) or may embrace many firms and can be limited to a single country or stretch across national boundaries (Kaplinsky and Morris, 2000). If a firm specialise in a certain stage of the value chain and establish linkages with input providers (upstream) and processors or distributors (downstream), these are usually referred to as vertical linkages (Kaplinsky and Morris, 2000). At the same time, firms tend to be embedded in horizontal linkages, whereby cooperative relationships exist with other firms at the same stage of the value chain (Hellin and Meijer, 2006). In addition, firms are connected with non-firm organisations such as employer's associations, trade unions, non-governmental organisations (NGOs), universities and government agencies (Gereffi, Humphrey, and Sturgeon, 2005). Many of the relationships do not directly influence the process of value addition and should therefore be distinguished from vertical value chain links (Kaplinsky *et al*, 2000).

Perroux (1955) as cited by Kaplinsky and Morris (2000), proposed the notion of growth poles that allow large industries with strong interactions and externalities to induce local growth. According to

Perroux's approach, investment in a firm produces demand effects that induce subsequent investments (backward linkages) by input suppliers while the output of the firm can be used as an input into another economic/productive activity. Thus, subsequent investments are also stimulated on the output side (forward linkages).

2.2.3 Forces impacting on value chains

In a paper prepared by Ag Education and Consulting (AEC), critical forces that affect the alignment of agricultural value chains are identified (AEC, 1999). These forces are subdivided into drivers, barriers, enablers and regulators of the value chain (See Figure2.1). Value chain forces are broad and encompass various sub-factors. Value chain drivers and enablers such as consumer demand and information technology positively affect the value chain by creating pressures on the sector to move towards higher alignment, while barriers and regulators such as lack of trust and willingness slow down or reverse the movement (AEC, 1999).

Over the past years, substantial restructuring downstream (retail) has not always matched upstream (farm) restructuring, and as such, uneven restructuring and alignment along the chain needs to be better understood (AEC, 1999). This phenomenon was explained by Vermeulen, Woodhill, Proctor, and Delnoye (2008), whose work identified an emerging retail sector in developing countries and transition economies which are increasingly controlling upstream segments of the supply chain through contracts, private standards and sourcing networks. The need for increasing the efficiency of value chains entails an understanding by emerging agricultural sectors of the various forces that are at play. Ideally, an efficient value chain must evolve from a "Low Value Chain Alignment" to "High Value Chain Alignment" (Figure 2.1).

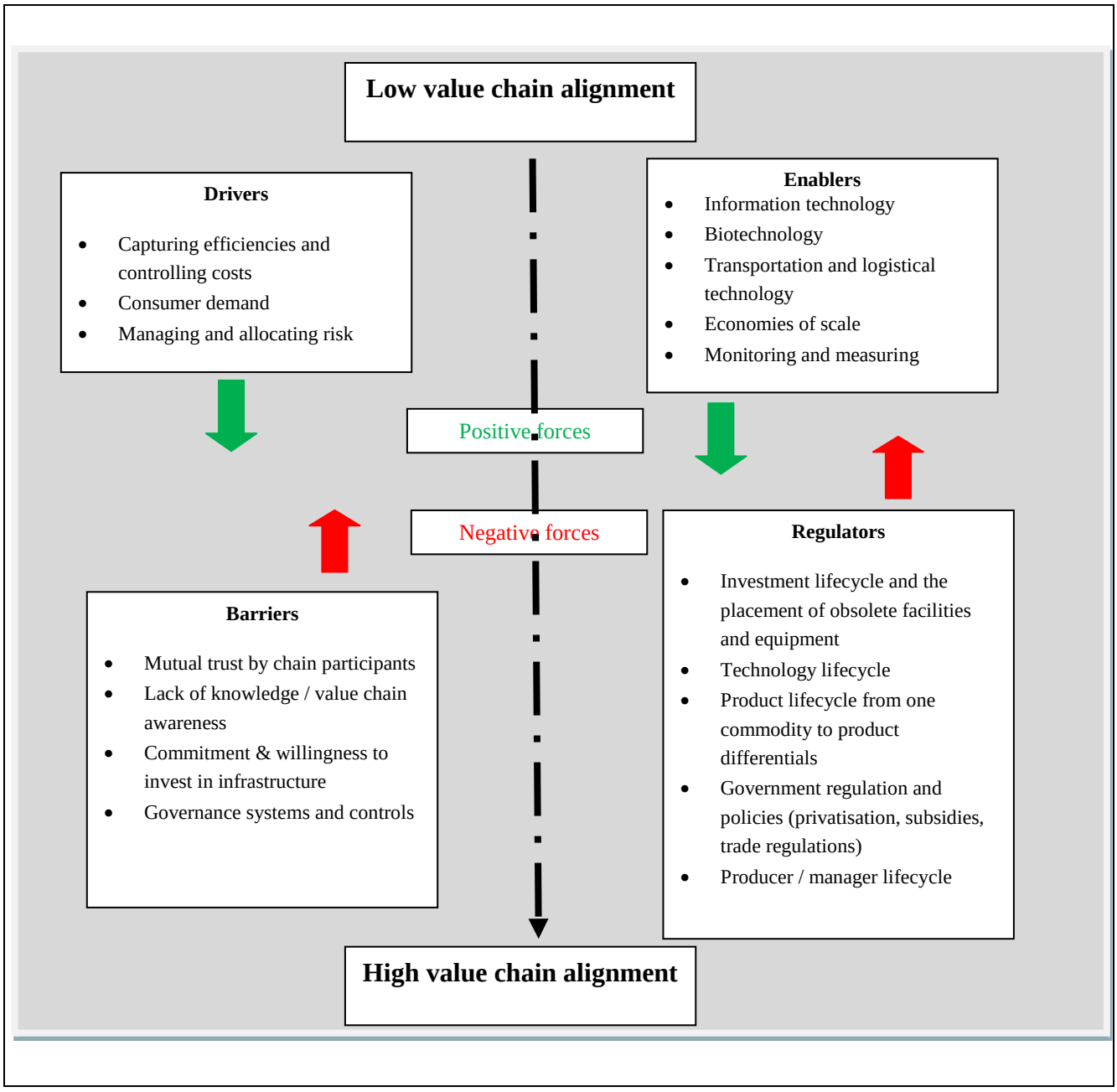


Figure 2. 1: Forces that affect the alignment of agricultural value chains
Source: Adapted from AEC, 1999.

The positive factors that promote value chain transition are grouped into "drivers" and "enablers" (Figure 2.1). As production commences, both drivers and enablers act as the favourable environment that boosts the value chain. Without strong drivers and value chain enablers, a value chain remains at a lower level, hence unprofitable for the farmer (AEC, 1999). It is important to note that the value

chain drivers and enablers are working against antagonistic forces imposed by barriers and regulators.

Barriers and regulators are meant to protect either the supplier or the consumer, hence can be unfavourable to either of the parties. This directly affects the development of the value chain. Removal of barriers and regulators makes value chains more efficient and profitable (AEC, 1999). This calls for continuous monitoring of individual value chains as well as implementing intervention strategies to improve efficiency of value chains.

2.2.4 Value chain integration

Theories of industrial organization and inter-firm relations provide a useful basis for understanding the nature of specific product value chain integration and its effect on firm performance. Scholars of industrial organization view business integration as a strategic tool in creating competitive advantage (Porter, 1998). There are two main types of integration namely horizontal integration and vertical integration.

From the perspective of transaction cost economics (TCE), vertical integration is viewed as one form of governance structure that is determined by attributes of transaction and assumptions of human behaviour (Williamson, 1985). While vertical integration has considerable benefits, there are significant risks and costs. Some firms may vertically integrate their activities with the objective of minimizing transaction costs, increasing their control over resources, capturing more rent, increasing entry barriers and foreclosing competitors (Khoi, 2007). However, vertical integration requires a high capital investment and it may result in reduced flexibility and increased bureaucratic costs (Khoi, 2007).

Horizontal integration is a theory of ownership and control (Porter, 1985). The horizontal integration strategy is often used by a business or corporation that seeks to sell one type of product in numerous markets (Porter, 1985). To get this market coverage, several small subsidiary companies are created and each markets the product to a different market segment or to a different geographical area (Porter, 1985). The horizontal integration of production is where a firm has plants in several locations producing similar products. Horizontal integration in marketing is much more common than horizontal integration in production. Another broader form of horizontal integration is that of regional integration of value chains. According to the Economic Report on Africa, prepared by the African Union and the Economic Commission for Africa (2009), one suggestion for strengthening Africa's agricultural sector is to integrate value chains within regions and across country borders.

Such integration can be achieved through coordination of actors, facilitating of actors, promoting inclusive standards along each step of value chains and harmonisation of policies and legal frameworks (Economic Commission for Africa, 2009).

2.2.5 Value chain governance

According to Williamson (1985) economic governance refers to how different economic institutions contribute to facilitating production and trade. These institutions include contracts and laws, business organizations, and cooperative enterprises. Governance is therefore predominantly concerned with ongoing contractual relations for which continuity of the trading relationships is a source of value (Williamson, 1985). In his Nobel prize interview in 2009, Williamson defined governance as the means to infuse order thereby mitigating conflict so as to realize mutual gains (Williamson, 2009). Williams (2009) cited Commons (1932) as "The ultimate unit of activity … must contain in itself the three principles of conflict, mutuality, and order and this unit is a transaction". Governance was therefore explained as a means by which to infuse order, thereby to mitigate conflict and realize mutual gain (Williamson, 2009).

Governance is realised when firms within the chain adhere to rules set by others (Humphrey, 2005). The rules that are put in place are effected and monitored for review. As such, Humphrey (2005) noted that both producers and suppliers have to comply to lead firm requirements. Compliance is assumed to have possible reward like long-term sustainable supply or long term larger volumes required while non-compliance can lead to sanctions such as expulsion from the supply chain, or reduction of purchases due to poor performances (Humphrey, 2005).

Governance in value chains can be placed in three categories: (i) Information flow within the chain that is crucial for coordinating activities within the chain (ii) the level to which information can be easily communicated and codified at production level (iii) the level to which suppliers are competent to achieve the requirements placed upon them (Humphrey and Schmitz, 2000). Value chain governance therefore can be governed by the existing characteristics of the chain.

The importance of value chain governance is emphasized by Gwynne (2006) whose work highlighted how financial, material and human resources are allocated within specific value chains. Gwynne (2006) also referred to a scenario whereby lead firms in an organisation exert authority on small firms as part of vertical coordination. Moreover, contracts are often used to tackle different aspects

within the chain, including quality, time of delivery and quantity among other aspects (Gwynne, 2006).

2.2.6 Value Chains in Agriculture

Globally, the agricultural industry is in the midst of major structural changes. Boehlje, Hofing and Schroeder (1999) suggest that agricultural production worldwide is changing from an industry dominated by family-based, small-scale, relatively independent firms to one of larger firms that are more tightly aligned across the production and distribution chain. Boehlje et al (1999) also noted that the input supply and product processing sectors are becoming more consolidated, more concentrated and more integrated. As such, the complex changes in the agricultural sector present pressures on the sector, hence the adoption of value chains to analyse the trends (Boehlje et al, 1999).

Scholars and development specialists have different views on the best strategies to upgrade smallholder agriculture. Literature emphasises the need for smallholder farmers in Africa to become increasingly involved in the production for sale of high value to weight items that also have high value-added, such as animal products, horticulture, and beverage crops, tradable items thought to be in Africa's comparative advantage (Jaffee & Morton, 1995). This school of thought emphasised the importance of promoting growth in smallholder agriculture in Sub-Saharan African countries through increased participation in growing world markets for high-value items. Delgado and Siamwalla (1997) pointed out that there is need for strong vertical integration of smallholders to processing and marketing firms to improve their market participation. This is principally due to missing or dysfunctional markets for some factors, inputs and outputs (Delgado and Siamwalla, 1997).

Value chain approach is more holistic in nature. Whilst general input-output relationships form the basis for most value chains, agricultural value chains are also driven by consumer demand (Boehlje et al, 1999). Product diversity is increasing and consumers expect quality control and products with specific characteristics to be available at each point in time (Boehlje et al, 1999). However, current efforts are meant to improve the efficiency of agricultural value chains. Support is needed to provide farmers with appropriate profitable market outlets and up to date market information to maximize their return and increase output with better quality standard (Saleque, 2007). For a particular product, to be transported from the farm gate to consumers, it usually has to pass through many different hands (Saleque, 2007). In the process , it is packed, unpacked, graded, sorted, handled and transported many times and this has implications not only for the quality of the product when it

reaches the consumer but also for the efficient organization of the agricultural marketing system (Saleque, 2007).

Characteristically, smallholder agriculture value chains are believed to be dominated by trading of unprocessed products. A study conducted by Bekele and Hailemarian (2007) shows that the structure of the chickpea markets in Ethiopia exhibit limited transformation or value addition as the grain moves within a given marketing chain. The bulk of the chickpea grain is transacted in unprocessed form (Bekele and Hailemarian, 2007). Ahmed (2005) also noted that agricultural value chain finance is very important for the small and marginal farmers to involve them in agriculture value chain system.

Resource use in agriculture value chains is very critical. Studies have concentrated on tradable resources like fertilisers, seeds, herbicides and machinery usage, with very minimal emphasis on land and water resource usage at smallholder level. This emanates from the problem of quantification and valuation of these resources at smallholder level, whose provision is mainly through government allocation and hence no financial payment are made. Usage of water resources at smallholder level depends on availability and not the cost of the resource for both crop and livestock systems.

2.2.6.1 Water resource-use in agricultural value chains

The growing pressure on finite freshwater and soil resources becomes increasingly clear that the challenge of feeding tomorrow's world population is, to a large extent, about improved water productivity within present land use, of which rain-fed agriculture plays a critical role in this respect (Kijne *et al*., 2003). The fear of rapidly growing water scarcity problems, especially in arid and semi-arid tropical regions of the world, is based on analysis comparing blue-water (rivers, dams) availability with actual blue-water withdrawals, and projections of future withdrawals based on general per capita water requirements (Kijne *et al*., 2003).

Various techniques have been used world-wide to determine productivity and usage of water by different categories in different sectors of production. Quantitative modeling techniques have been used to show linkages between primary productive sectors (agriculture) and secondary sectors (manufacturing and processing) with respect to water usage in these sectors (Smit, 2009). These have resulted in the adoption of the concept of the water footprint (Smit, 2009).

The water footprint of a country is defined as the volume of water needed for the production of the goods and services consumed by the inhabitants of the country (Hoekstra & Chapagain, 2006). The internal water footprint is the volume of water used from domestic water resources while the external water footprint is the volume of water used in other countries to produce goods and services imported and consumed by the inhabitants of the country. The four major direct factors determining the water footprint of a country are: (1) volume of consumption (related to the gross national income); (2) consumption pattern (e.g. high versus low consumption); (3) climate (growth conditions); and (4) agricultural practice and water use efficiency (Hoekstra & Chapagain, 2006).

South African Breweries, as a specific example, undertook an investigation to calculate its water footprint in 2008 to determine efficiency of water usage in the production system. According to Smit (2009), the report defines a water footprint as an indicator of water use that looks at both the direct and indirect water use of a consumer or producer. SAB assumed that the water footprint starts with the cultivation of the crops that are used in beer brewing (barley, wheat, hops) and follows all the processes through to bottling of the final product and any possible recycling) (Smit, 2009). This represents a very long value chain for industrial crops as well as showing high water value for each stage of value addition.

The water footprint concept is closely linked to the virtual water concept, which was introduced in the early 1990s (Hoekstra & Chapagain, 2006). Virtual water is defined as the volume of water required to produce a commodity or service, and has been widely used as a partial solution to problems of water scarcity in the Middle East and Africa (Hoekstra & Chapagain, 2006). The virtual water content differs for crop and livestock enterprises and Figure 2.2 shows the global virtual water budget allocations.

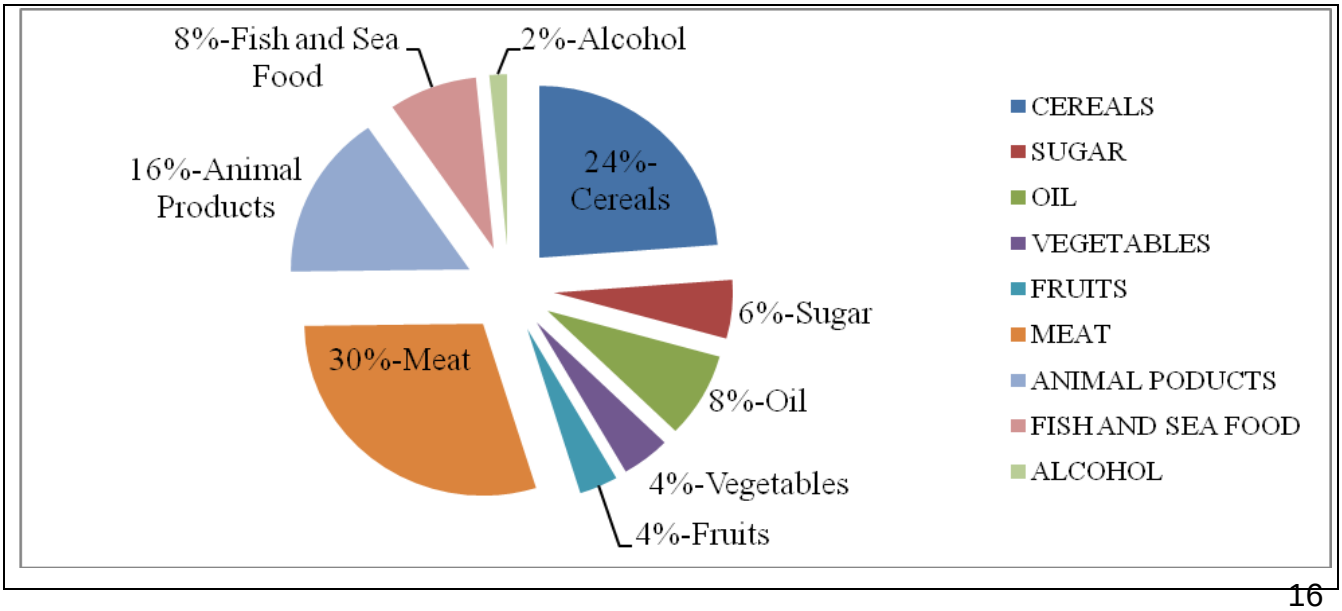


Figure 2. 2: Distribution of global water embedded in food products in 2000 (5 200 Km3).
Source: Zimmer and Renault, (2005). World Water Council - FAO AGLW.

The global budget on water embedded in food products (Figure 2.2) shows that meat and animal products represent about 45 % of the budget, whereas cereals account for 24%, fish and sea food account for 8% and oil for 8%.

The total volume of water used in the agricultural sector is based on the total volume of crop produced and its corresponding virtual water content (Hoekstra & Chapagain, 2006). It is also based on crop water requirements and yields (Zimmer and Renault, 2005). The virtual water content of crop products is calculated based on product fractions (value of crop product obtained per tonne of primary crop) and value fractions (the market value of one crop product divided by the aggregated market value of all crop products derived from one primary crop) (Hoekstra & Chapagain, 2006).

The virtual water content (m^3/ton) of live animals is calculated based on the virtual water content of their feed and the volumes of drinking and service water consumed during their lifetime (Hoekstra & Chapagain, 2006). However, calculation of the virtual water content of livestock products is again based on product fractions and value fractions (Hoekstra & Chapagain, 2006). It is suggested that livestock products have higher virtual water content than crop products, mainly because a live animal consumes a lot of feed crops, drinking water and service water in its lifetime before it produces some output (Zimmer and Renault, 2005). An example of beef produced in an industrial farming system was analysed and it was realised that it takes an average of 3 years before it is slaughtered to produce about 200 kg of boneless beef (Hoekstra & Chapagain, 2006). During this period it consumes nearly 1300 kg of grains (wheat, oats, barley, corn, dry peas, soybean meal and other small grains), 7200 kg of roughages (pasture, dry hay, silage and other roughages), 24 m^3 water for drinking and 7 m^3 water for servicing. The higher in the product chain a good is, the higher will be the virtual water content of the product (Hoekstra & Chapagain, 2006). For example, the global average virtual water content of maize, wheat and rice (husked) is 900, 1300 and 3000 m^3/ton respectively, whereas the virtual water content of chicken meat, pork and beef is 3900, 4900 and 15 500 m^3/ton respectively (Hoekstra & Chapagain, 2006).

In crop farming, water use is split into irrigated and non-irrigated (rain fed), while in livestock farming is split into intensive (with irrigated pastures) and extensive (free range) systems. The proceeding sections discuss water use patterns within the various farming systems.

2.2.6.2 Water resource use in irrigated crop value chains

Due to climate change that has resulted in frequent droughts and erratic rainfall, irrigation farming is increasingly becoming the cornerstone to ensure global food security. Water usage varies between crops and between the different stages of growth of a particular crop. Thus crop co-efficients for evapo-transpiration vary between crops and also according to the stage of growth of the crop (Sharma, 2006). One of the modern techniques developed to estimate water usage in agriculture involves the use of the CROPWAT model. This is a decision support system developed by the Land and Water Development Division of FAO for planning and management of irrigation (Marica, 2006). It assists with drawing up national water budgets and forecasting future requirements.

CROPWAT is a practical tool to carry out standard calculations for referencing evapo-transpiration, crop water requirements and crop irrigation requirements, and more specifically the design and management of irrigation schemes (Marica, 2006). It allows the development of recommendations for improved irrigation practices, the planning of irrigation schedules under varying water supply conditions, and the assessment of production under rain fed conditions or deficit irrigation (Marica, 2006).

Crop water productivity is the amount of water required per unit of yield and a vital parameter to assess the performance of irrigated agriculture (Sharma, 2006). It will vary greatly according to the specific conditions under which the crop is grown[1].

The productivity of water used in agriculture increased by at least 100% between 1961 and 2001, with a corresponding increase in crop yields (Sharma, 2006). Improving water productivity requires, first, an increase in crop yields or values (i.e. the marketable yield of the crop for each unit of water transpired) (Sharma, 2006). Also necessary are a reduction of all outflows or "losses" (e.g. drainage, seepage and percolation) except crop transpiration, and more effective use of rainfall, stored water, and water of marginal quality (Sharma, 2006)

Achieving higher water productivity requires changes in crop, soil and water management and strategies including selection of appropriate crops and cultivars, use of improved planting and cultivation practices (e.g. minimum tillage), synchronisation of water applications with the most

[1] http://www.fao.org/nr/water/topics_irrig_cropwat.html

sensitive growing periods, and improved drainage for water table control (Sharma, 2006). Techniques and practices that reduce water evaporation (e.g. mulching) will also improve water productivity, while improved nutrient management will increase yields at a greater rate than it increases evapo-transpiration (FAO, 2003).

To summarise, Sharma (2006) suggest the following strategies to increase crop water productivity:

- Increasing production per unit of water consumed,
- Reducing non-beneficial depletion (e.g. evaporation losses from fallow land, reduced deep percolation)
- Tapping uncommitted outflows (i.e. using outflows or increasing the size of storage facilities).
- Re-allocating water between user (i.e. crop-livestock combinations are much more productive than systems only involving crops)

Most existing smallholder irrigation schemes worldwide were developed for the purpose of crop production yet integrating animal and crop production offers potential advantages (FAO, 2003). In South Africa current policies do not support the integration of animal and plant production, where smallholder irrigation development has paid little attention to the potential of integrating animal and crop production (Averbeke and Mohamed, 2004). Growing crops to feed animals represents a value-adding process that reduces bulk costs, which in turn can reduce the contribution of transportation to the cost or marketing products (Averbeke and Mohamed, 2004). The manure produced by animals is also a valuable resource which when returned to the irrigated land can help to replenish soil fertility and improve the physical properties of the soil (Averbeke and Mohamed, 2004). Incorporating animal production enterprises on irrigation schemes can also provide a productive use for organic wastes, such as crop residues and crops for which no market could be secured (Averbeke and Mohamed, 2004). Where slopes require terracing of the irrigation land, which is often necessary when surface irrigation is practiced, the bunds and terrace walls can be planted to tree legumes or tall fodder grasses, which also serve as wind breaks of land, thereby increasing the intensity of production (Averbeke and Mohamed, 2004).

Irrigation is the major user of water in South Africa. Irrigated agriculture generally depends on engineered structures and field layouts to make the best possible economic and technical use of water that has been pumped or stored, usually at considerable cost. The full range of irrigation systems is found on various schemes across South Africa, namely flood, sprinkler, centre pivot, and micro and

drip irrigation, with sprinkler irrigation being the most common (DWAF, 2006). Small-scale vegetable irrigation farming plays a significant role in rural and urban areas in South Africa, where an estimated 150 000 growers participate on community gardening projects and an unknown number grow food in home gardens (NDA, 2006).

Irrigated food plots, where groups of farmers share infrastructure for water supply, constitute one of the biggest success stories in agricultural development in South Africa. Their success is in sharp contrast to the problems of many of the sophisticated top-down managed larger irrigation schemes. Community gardening (or irrigated food plots) provides individuals with the opportunity to develop virtually a full range of entrepreneurial and farming skills on a small enterprise, as growers have autonomy in decision-making on cultivation and marketing, yet have to cooperate in an organisational structure around shared water supply, infrastructure and equipment. Community gardening and irrigated food plots can provide the poorest of poor people the opportunity to improve their standard of living, and participants are mostly women.

With smallholder farmers, the sharing of a common water source by a group is common in South Africa, and is perceived to limit members' flexibility in terms of irrigation. The choice of suitable technology is one mechanism to ensure as much flexibility for each individual farmer as possible (DWAF, 2006). The irrigation technology on some centrally managed schemes in South Africa has been adapted and/or expanded to increase flexibility and manageability by farmers. According to DWAF, it has been established that the successful sharing of water resources requires that the group of farmers be well organised and equipped (trained) to control, operate and maintain their infrastructure and manage their finances.

Independent irrigation farmers are those not participating in an irrigation scheme or in a gardening group and who have a "private" water supply, such as pumping directly from a river or from their own borehole (NDA, 2006). Whereas the majority of the subsistence farmers and smallholder farmers consider farming as an additional income source as part of their multiple livelihood strategy, independent irrigators are often bona fide farmers, aiming to make a living out of farming, and as such many are shopkeepers or other entrepreneurs who develop irrigation as an added dimension. Independent farmers typically start their irrigation enterprises using their own or family capital and build it up over a period. These enterprises range from the very small vegetable or fruit tree plots, to fairly large commercial units as much as 100 hectares of intensive crop cultivation under sophisticated drip irrigation. Although the “independent farmer" sector is believed to form a

significant component of small irrigation farming in South Africa, there are virtually no statistics on independent farmers, as they are not being financed or managed by formal institutions (NDA, 2006).

2.2.6.3 Water resource-use in rain-fed crop value chains

Rain-fed agriculture is the type of farming that is most typically practised by the world's rural poor and is dependent on natural rainfall patterns. Small-scale, rain-fed crop production is frequently characterised by low output and farmers therefore rarely actively participate in long value chains, as they often remain at a subsistence level and even supplement their yields through non-agricultural income (Dhar *et al*., 2001*).* Studies conducted by the International Centre for development-oriented Research in Agriculture (ICRA) in the Herschel District of Eastern Cape in 2001, as reflected in Textbox 2, clearly support the view of low output among small-scale rain-fed crop farmers (Dhar *et al*., 2001*).*

Textbox 2:

Rain-fed crop yields of small-scale farmers in the Eastern Cape

According to extension workers, the expected yield of different cultivars of wheat under water stress conditions and poor management conditions should be between 1500 and 2500 kg/ha. However, based on the information obtained from farmers, indications are that they get an average of eight bags (80 kg each) from one morgen (0.856 ha), which equates to about 700 kg/ha.

Similarly, the potential yield of maize cultivars under such conditions ranges from 1400 to 2600 kg/ha and yet farmers from the Storom village informed researchers that they obtained about 25 bags (60-65 kg each) from one morgen, which is almost equal to 1700 kg/ha".

Following the same trend, the potential yield of sorghum cultivars under the conditions in the district ranges from 1200 to 2000 kg/ha and yet Storom village farmers said that they get about 8 bags (60-80 kg) from one morgen, which equates to approximately 600 kg/ha.

Source: Dhar *et al.,* 2001.

The scenario shown in Textbox 2 illustrates one of the major sources of distress and causes of food insecurity among rural inhabitants in the Eastern Cape and it can be assumed that this is the general trend among smallholder farmers in South Africa. Further exacerbating the problem of low output on

per hectare basis is the poor state of markets, which also emerged from personal interviews conducted by ICRA in the Tapoleng village in Eastern Cape.

Rain-fed agriculture has of late received attention from researchers with the intention of improving output from this generally risky system. Baiphethi (2004) performed an economic evaluation of water conservation systems for dryland crop production by small-scale resource poor famers in Free State Province of South Africa. The driving force behind Baiphethi's study was the evidence of low farm returns and high risk of crop failure mainly due to inadequate and erratic rainfall experienced by farmers who depend purely on conventional farming methods. As a result of low farm returns and the high risk nature of their enterprises, most farmers in the Thaba Nchu study area in the Free State Province gave up crop farming and the few who still grow crops have to deal with high levels of risk and uncertainty, inadequate moisture, and generally low returns, often at a great cost to their limited resources (Baiphethi, 2004).

Baiphethi (2004) made a comparison of the performance of conventional rain-fed and rain production that makes use of infield water harvesting techniques. The study concluded that about 80% of the time, the conventional technique will yield gross margins that are negative or equal to zero, while contrary to this, the least productive in-field water harvesting technique was found to have only a 36% chance of yielding a gross margin of zero or less. Baiphethi (2004) concluded that the high risk nature of conventional production techniques was partly responsible for the high number of crop farmers who have stopped crop farming.

Crop water productivity of rain-fed crops is equal to crop yield (kg) / rainfall (m^3) and some crops are more adaptable to moisture stress than improved higher yielding varieties (Igbadun, Mahoo, Tarimo, and Salim, 2004). In addition, timing of rainfall events is also critical in terms of the stage of growth of the crop. (Igbadun *et al*, 2004).

There is a need to place more emphasis on small-scale water management in rain-fed agriculture through the redirection of water policy and investment in infrastructure, given that 93% of farmed land in Sub-Saharan Africa is rain-fed (Igbadun *et al*., 2004). The scope of water management policy needs to be widened beyond irrigated agriculture to include rain-fed activities, which also include grazing and forests (Rockstrom *et al.* (2007). The fact that there is limited new land available to be put under agriculture makes it particularly important to find ways of increasing productivity through increasing productivity of water-use in these systems (Igbadun et al., 2004).

There is evidence to suggest that the low crop productivity in rain-fed agriculture is due more to suboptimal performance related to management aspects than to low physical potential (Rockström, Folke, Gordon, Hatibu, Jewitt, Penning de Vries, Rwehumbiza, Sally, Savenije and Schulze, 2004). This means that in the developing countries with the most rapid population growth, there is high dependence on rain-fed agriculture operating at suboptimal level.

Rockström, Hatibu, Oweis, and Wani (2007) highlighted that upgrading rain-fed agriculture has the potential to result in significant returns on investment. The idea is to improve water availability and the water uptake capacity of plants through such interventions in order to increase yields (Rockstrom *et al*. 2007). Considering the importance of rain-fed agriculture in developing national economies, there is need for system innovations that aim at improving water productivity (increasing water use efficiencies) while conserving resources (Rockström *et al*., 2004).

According to Rockström, Karlberg, Wani, Barron, Hatibu, Oweise, Bruggeman, Farahani, and Qiang (2009), the most promising avenue to upgrade rain-fed agriculture in regions with water constraints is to break the conceptual divide between rain-fed and irrigated crop production and invest in blue water management options for rain-fed agriculture (e.g., supplemental irrigation). It is suggested that this will be an important strategic step toward improving institutional priorities regarding investments in rain-fed agriculture and will also provide a larger set of management alternatives, ranging from fully rain-fed to fully irrigated systems (Rockstrom *et al.* 2009).

In rain-fed agriculture, the key limitation is not the shortage of water, but rather it is the extreme variability and the incidence of high intensity storms and droughts (Rockstrom *et al.*, 2007). Emphasis must therefore be on securing water to bridge dry spells and drought proofing and to increase agricultural and water productivity through new technological water management options, facilitated through institutional and policy interventions (Rockstrom *et al.*, 2007).

The reduction of water-related risks due to rainfall variability is an effective mechanism to unlock agricultural potential (Baiphethi, 2004). This is to be achieved by a number of different mechanisms. Firstly, rainfall in farmers' fields can be managed by the implementation of *in situ* soil and water conservation practices (Baiphethi, 2004). More so, interventions and practices that maximise infiltration rates and soil water holding capacity will have positive impacts on crop yields.

Of late, in-field rainwater harvesting (IRWH) has also been promoted in South African smallholder farming. The roles and functions of these water harvesting techniques are threefold, viz. to (i) stop

infield runoff, (ii) maximise infiltration and (iii) store the harvested water in the soil surface beneath the basin (Baiphethi, 2004). The stoppage of infield runoff is a very important characteristic, which directly explains yield advantages obtained from IRWH systems in comparison to conventional rain fed approaches (Baiphethi, 2004). The basin area of the IRWH system, where the water is temporarily stored until infiltration is complete, acts as a surface storage medium where the "loss" can be converted into a "gain". Ex-field runoff is one of the major processes responsible for unproductive water losses in agriculture. Various short- and long-term studies on mono-cropped maize estimate that these losses can vary between 8 and 24 percent of the total annual rainfall, depending on rainfall intensity, soil characteristics and topography (Haylett, 1960; Du Plessis and Mostert, 1965; Bennie et al., 1988 in Baiphethi, 2004).

In addition to *in situ* water capture interventions, it is also necessary to invest in structures that add new freshwater to the system through local management of run-off and rainfall. Investments in supplemental irrigation and conservation agriculture practices lead to an increase in the consumption of green water.

Supplemental irrigation is seen as an effective mechanism to increase yields and water productivity substantially in small-scale agriculture. It should also be noted that a programme cannot focus only on water management though, and should also consider improvement in agricultural practices and land tenure. In terms of human capacity, ability to adapt and innovate should also be strengthened as should local institutions (Rockstrom *et al.*, 2007). The relative contribution to system productivity of supplemental irrigation is assessed by calculating the incremental increase in water productivity for supplemental irrigated treatments (i.e. kg additional grain produced per mm of supplemental irrigation) (Kijne *et al*., 2003).

Another aspect to consider is the need to improve environmental sustainability since poor management is known to increase run-off resulting in soil erosion, loss of nutrients and reduced crop yields. Much water stress affecting crops is actually human-induced. Only 70-80% of rainfall received is actually available to plants as soil moisture and this percentage declines if soil is poorly managed. Poor management practices can result in 'droughts' in the root zone and as little as 5% of rainfall is actually used by plants on severely degraded land (Rockstrom *et al*., 2007). The partitioning of rainwater in the semi-arid tropics is shown in Figure 2.3 to illustrate how rainwater is lost to the system.

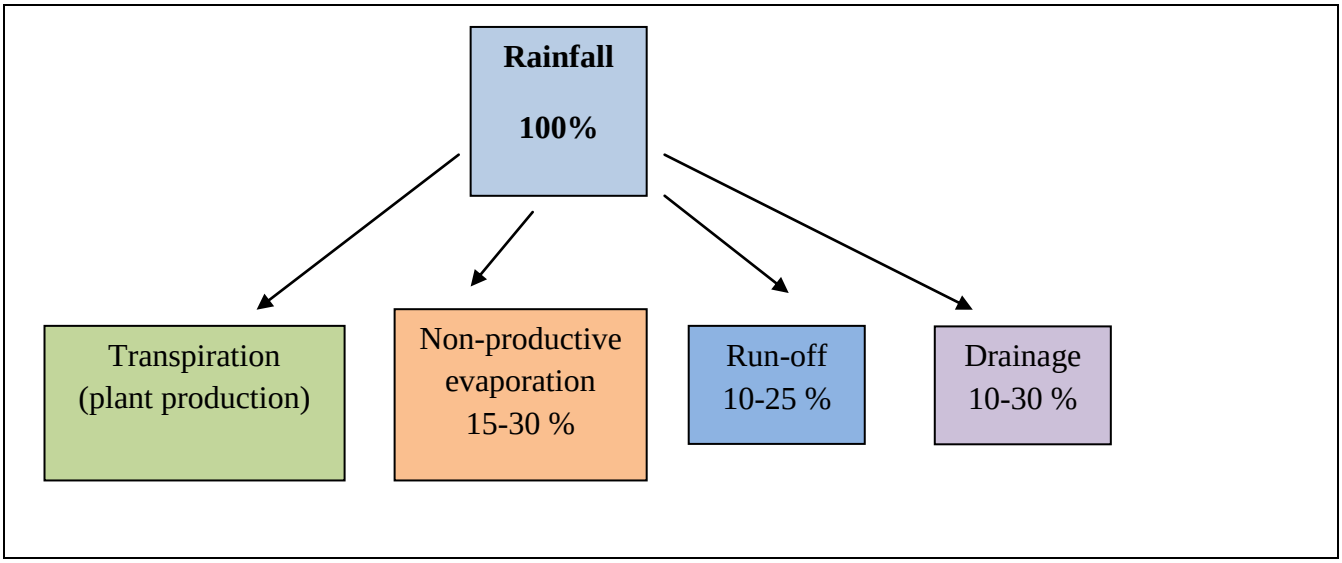


Figure 2. 3: Partitioning of rainfall in semi-arid tropics
Source: Adapted from Rockstrom *et al*. (2007).

Other authors have suggested that between 70 and 85% of rainfall can be considered 'lost' to the cropping system as non-productive green-water flow (as soil evaporation) and as blue-water flow (deep percolation and surface runoff) (Sivakumar and Wallace, 1991; Rockström et al., 1998; Mahoo et al., 1999 in Kijne *et al*., 2003).

The focus in terms of upgrading rain-fed agriculture should be on managing the green water resource and by capturing more soil moisture for plant uptake (Kijne *et al*., 2003). Increasing the amount of water in the root zone is achieved by decreasing run-off, redirecting upstream run-off to the farm, maximising plant uptake capacity and reducing deep drainage / percolation (Kijne *et al*., 2003). Practices to increase water productivity include mulching, drip irrigation and increased canopy cover so as to reduce evaporation (Rockstrom *et al.*, 2007).

Small-scale water harvesting consists of three components: (1) water shed where water is captured, which can be outside the cultivated area, (2) storage facility, which can be *in situ* storage or can involve storage structures such as tanks or dams and (3) the target area for beneficial water use. Techniques to concentrate and convey run-off to the target area can include terraces, bunds and micro-basins. Another measure to increase plant production is to increase infiltration and reduce evaporation through increased plant cover in favour of increased transpiration (Rockstrom *et al*., 2007).

Capturing run-off for supplementary irrigation in smallholder farming systems can be achieved with water-harvesting systems that collect local surface runoff in small storage structures (Kijne *et al*., 2003). For resource-poor smallholder farmers in water-scarce areas, even small volumes of stored water for supplemental irrigation can significantly improve the household economy (Kijne *et al*., 2003). In the Gansu Province in China, small 10 – 60 m^3 (on average 30 m^3) subsurface storage tanks are promoted on a large scale. These tanks collect surface runoff from small, often treated, catchments (e.g. with asphalt or concrete), and later used for supplementary irrigation during dry periods (Kijne *et al*., 2003). It is also important that captured water be used at critical stages of plant growth in order to optimise yields. Investments should also be made in improving soil fertility because this is recognised as one of the major factors limiting crop production and investments are said to result in a direct improvement of water management and efficiency of water use (Rockstrom *et al*., 2007). Upgrading rain-fed agricultural systems results in increased returns on labour and rainfall needs to be seen as an economically important fresh water resource (Rockstrom *et al*., 2007).

2.2.6.3 Water resource use in livestock value chains

Livestock production is diverse and covers small livestock (poultry, goats, sheep, and rabbits) and large livestock (cattle, horses, donkeys) being kept under either intensive or extensive production systems. The focus of this literature review is on smallholder livestock production, which is generally part of mixed crop-livestock system in South Africa. Livestock value chains among rural smallholder farmers are very short, with meager returns (See Textbox 3).

The Pro-Poor Livestock Policy Initiative of the Food and Agriculture Organisation (FAO) identifies various factors and trends which affect rural livestock production and small-scale livestock producers in Sub-Saharan Africa. These include:

- Increasing pressure on common grazing and water resources
- A shift in livestock production from a local, multi-purpose activity to an increasingly market-oriented and vertically-integrated business
- Strong growth of industrial production units reliant on the use of cereal-based feeds close to urban centres.

Textbox 3: Income from livestock

A study in Tapoleng village identified a farmer who owned 8 heads of cattle, 12 sheep and 5 pigs, said that on average he gets 1 - 2.5 litres milk/day/animal and sells the milk at a rate of R2 per litre. This results in an average income from milk of R60 - R70 per month. From the sale of wool, he earns R30-35 per year, and during the previous year he sold one beast for R1 500.

Another farmer, owning 10 cattle, informed researchers that the average milk production from his herd was five litres per day. He also said that this milk was used for home consumption, and was not sufficient for the family."

Source: Dhar *et al*, (2001).

The cases of the farmers in Textbox 3 clearly indicate that income from livestock is very low among smallholder farmers. Challenges to livestock production include the lack of competitive markets for the livestock and the livestock products. Dhar *et al.* (2001) also noted that breed improvement is difficult as animals graze communally and farmers do not wish to invest in a bull that will also fertilise cattle belonging to other people in the community.

The benefits of livestock production systems in terms of water productivity, are reflected by the fact that if surplus feed is available, the provision of one litre of drinking water effectively results in an additional 100 litres of otherwise unusable agricultural water evapo-transpired from rangeland vegetation. Livestock can be efficient and effective users of water when they depend largely on crop residues and by-products and on well managed rangelands unsuitable for crop production (Peden, Tadesse, and Misra, 2007).

While irrigated pastures represent increased water usage in animal enterprises, this system is not common among rural smallholder farmers, who are resource-constrained (Mati *et al*. 2005). Rain-fed livestock farming in Kenya is therefore the core system in communal agriculture and water usage plays mainly a maintenance function through its usage as drinking water (Mati *et al*. 2005). In areas where water is very scarce, access to sufficient water to meet even the drinking requirements of livestock can be problematic and can require that animals travel long distances to reach a water source (See Textbox 4)

Textbox 4: Water resource stress can lead to conflict

Competition for access to water resources for livestock can result in conflict between livestock owners, as illustrated by the following case from Kenya.

In the drought-prone Isiolo District, where annual rainfall varies between 252 and 623 mm, conflicts have developed between groups of livestock owners over access to water. The deficits in the dry season are large due to upstream irrigation abstraction.

Access to water resources is largely a function of distance that livestock can travel. The maximum distance for cattle to travel is 10 km. However, under stress conditions, pastoralists set the maximum distance at 30 km (a 60 km round trip). Poor water distribution also results in poor utilisation of forage because livestock owners cannot keep their livestock in such areas for long.

Traditionally in this part of Kenya, people are not permitted to deny access to water and they allow access to water for cattle from other clans, but the cattle are not allowed to graze around the water source.

Source: Mati *et al*. (2005)

Water-use for livestock production equates to some 8% of global human water use, with the main user being the irrigation of feed crops (FAO, 2006). Livestock generates 25% of agricultural GDP in Sub-Saharan Africa but water scarcity is one factor responsible for low livestock productivity, and hence low returns for poor livestock farmers. Efforts to address infrastructural limitations need to be accompanied by interventions to address governance and institutional matters such as the allocation of water between diverse groups of users (Opio, 2009). Investments in water and livestock have often failed to achieve maximum and sustainable returns because of a lack of integration of the two (Peden *et al.*, 2007).

Water use in livestock involves watering of livestock, production of feed (produced by transpiration), crop production, waste disposal, maintaining animal health and hygiene, and processing of agricultural products (dairy products, slaughter facilities, meat packaging, etc) (Peden *et al.*, 2007). Water used for meat processing is variable, but is said to be less than 2% of that needed for feed production (World Bank 1998, cited by Peden *et al.* 2007). Drinking water accounts for less than 2% of all water used for livestock production (Peden *et al*., 2007), with water used for the production of feed being much more substantial, since 1g of dry matter of crop produced requires some 200 - 800g of water (Schwartz, 2008).

Livestock Water Productivity (LWP) is equal to the value of beneficial outputs (products and services) / amount of water depleted in producing them (Owoyesigire, Mpairwe, Mutetika, Bashasa, Kiwuwa, and Peden, 2006). Livestock outputs can include the value of ploughing, value of milk,

manure, meat as well as hides and skins (Owoyesigire *et al.,* 2006). Some authors suggest that livestock water use efficiency should involve expressing the value of products and services relative to the value of water depleted, degraded or devalued (Schwartz, 2008). This is important because inappropriate grazing and watering practices contribute to widespread degradation of water and land resources, particularly around watering sites. Peden *et al.* (2007) suggests that LWP differs from water or rain-use efficiency because it looks at water depleted rather than at applied or inflowing water.

Introducing animal management practices that promote useful transpiration or infiltration of available water will likely increase livestock water productivity (LWP). In order to improve LWP, it is also necessary to select feeds (crops) that meet the feed requirements of the animals (based on their age and reproductive state) and which have high water productivity relative to other uses for agricultural water. Increasing LWP will also depend strongly on increasing the amount of feed animals use for production relative to the amounts used for maintenance (Peden *et al.,* 2007). Livestock water productivity is also affected by access and ownership of the key resources, namely land, water and livestock.

Peden et al. (2007) suggests four basic livestock development strategies that can lead to more productive and sustainable use of water resources, namely:

- Improving the sourcing of animal feeds
- Enhancing animal productivity (products, services, and cultural values) through better veterinary care, genetics, marketing of animal products, and value-added enterprise
- improving watering and grazing practices to avoid degradation of land and water resources
- Providing quality drinking water.

Haileslassie *et al.,* (2009) suggested that engaging in multiple-livestock use strategies can make animal production more water productive at a watershed scale.

2.3 Review of value chain analysis methodologies

Value Chain Analysis involves investigating the direct functions of primary production, collection, processing, wholesaling and retailing, as well as the support functions, such as input supply, financial services, transport, packaging and advertising (Knopp, 2008). Traditional value chain analysis focused on the transaction level, incorporating a mapping of market actors along the functions and market channels of a particular industry. This is often complemented by a breakdown of production costs from raw material to finished product to identify inefficiencies from a cost perspective, which are often benchmarked against similar industries in other countries (Knopp, 2008).

It has been realised that in the past there may have been too much focus on increasing production without sufficient attention to markets and the role of effective supply chains (Vermeulen et al, 2008). In a bid to explain what happens to agricultural products from production to final utilisation along specific value chains, comprehensive tools and guidelines have been designed world-wide. However, the complexity of each value chain requires the identification of a suitable approach to analyse it.

2.3.1 Qualitative value chain analysis

Global commodity chain analysis aims to identify and measure the balance of power between the participating actors (Raikes, Jensen, and Ponte, 2000). The Global Commodity Chain (GCC) framework developed by Gereffi has attracted significant attention since the early 1990s (Gereffi 1994b; Raikes et al. 2000). The framework is tied to the concept of governance. Global commodity chains analysis (GCCA) does not measure input and output flows at various stages of the product's life cycle quantitatively; instead, it rather evaluates the social relationships and balance of power between all actors involved in the chain qualitatively (Fabe, Grote, and Winter 2009).

According to Kaplinsky & Morris (2000), a value chain analysis using the GCC framework can involve the following activities:

- Identifying the point of entry :- for example, if one's interest is in agricultural producers then the point of entry is the farm and one would then map forward to processors and their customers and backwards to input suppliers

- Mapping the value chain: - this involves gathering data from key respondents at each link in the chain and preparing a 'tree' of input-output relationships and identifying gross output values, net output values , flow of services and skills, employment, destination of sales , imports and exports
- Identifying the product / market segments and critical success factors (CSFs) for each segment
- Identifying how producers access final markets:– identifying key buyers and charting the CSFs that they exercise
- Mapping governance: – involves looking at power / level of influence of actors in terms of their share of chain sales, value added, buying power as well as the identification of those players that 'make the rules' and those that have to keep to them
- Investigating 'upgrading' along the chain :– this is the process whereby firms or actors innovate at a rate greater than their competitors in order to be competitive and successful
- Investigating distributional issues: – this analysis involves both power, balance of leverage of different parties and income returns that accrue to different parties. The distributional issues involve obtaining data on value added at each stage in the production of a good or service (Kaplinsky and Morris, 2000). Profitability, which can be used as an indicator of the distributional outcomes, can also be determined by either considering the return on net assets, the margins on sales or the apportionment of total profit throughout the chain. The distribution of skills along the value chain can also be analysed. Mapping the distribution of rewards along the value chain is also a key part of the analysis.

Vermeulen *et al.* (2008) identified six key components that should be considered when undertaking a value chain analysis. While some of them overlap with the set of activities suggested by Kaplinsky and Morris (2000), they do give a concise summary of the aspects to be considered, namely.

- Mapping out the value chain by identifying the main actors and the flows of products, money and information
- Mapping key policies and institutions that influence the functioning of the value chain and the inclusion and exclusion of small-scale producers
- Establishing the key drivers, trends and issues affecting the value chain and its actors (where drivers' influences change in the chain and trends indicate the directions of change such as prices and marketing channels)
- Exploring future scenarios in relation to uncertainties about drivers and trends and their implication on both small-scale and large-scale producers
- Identifying the options for better inclusion of small-scale producers

- Developing strategies for supporting change of policies and institutions within the public, private and civil society sectors.

Governments and aid agencies rely on hybrid models in tackling value chain related problems, hence the use of both qualitative and quantitative analysis techniques.

2.3.2 Commodity value chain mapping

Value Chain Analysis overcomes important weakness of traditional sectoral analysis which tends to be static (Kaplinsky and Morris, 2000). Value Chain maps are illustrated either vertically or horizontally in such a way that they depict all "upstream" activities and functions (input supply, farming activities) and "downstream" activities like processing, wholesaling and retailing of products. Chain segments are normally represented by boxes that are linked by arrows in order to symbolise product, information or monetary flows (Da Silva and Filho, 2007). Figure 2.4 shows a generic value chain system.

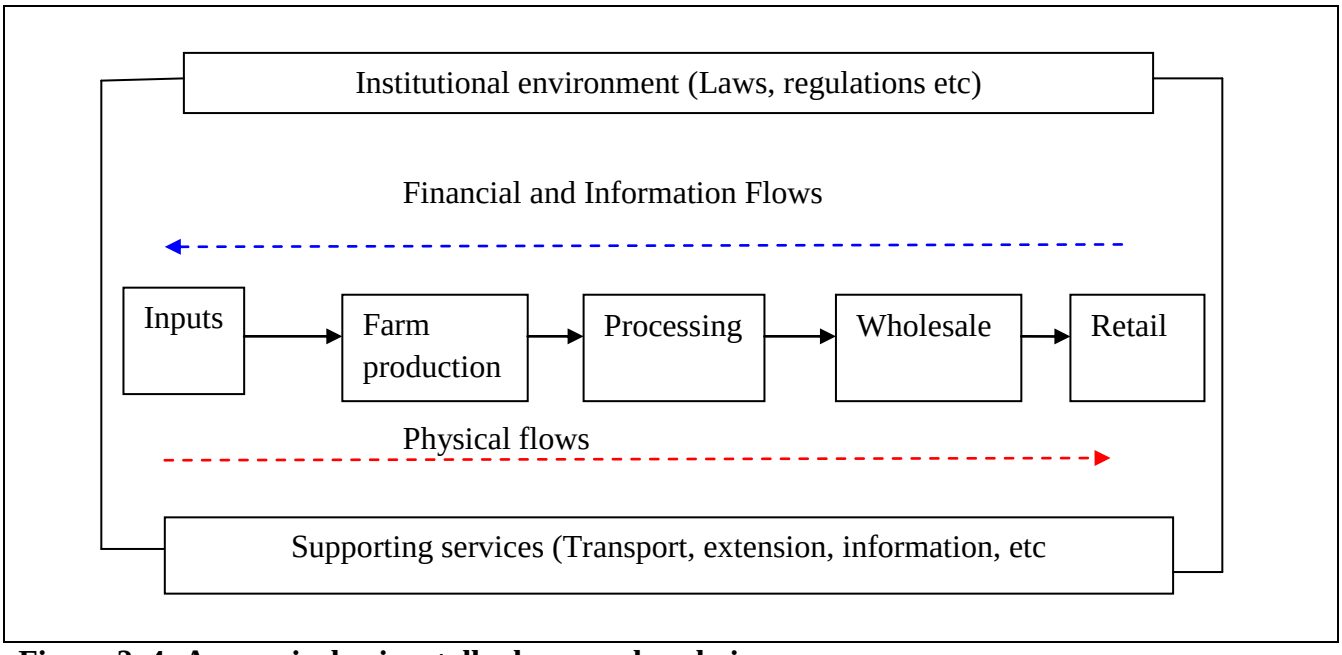


Figure 2. 4: A generic, horizontally drawn value chain map
Source: Adapted from Sebrae, 2000, as cited by Da Silva and Filho, 2007. P27

It is imperative to note that, while most competitive value chains involve a lot of value addition and high product differentiation, this is not always the case with smallholder farmers, who in most instances just supply raw and fresh products to the market (Bekele and Hailemarian, 2007). It is believed that processors brokers and some agricultural commodity traders have managed to make super normal gains from agricultural commodities at the expense of the farmer (Bekele and Hailemarian, 2007). Several factors could be at play, including lack of knowledge and poor resource endowments on the part of the farmers.

Vermeulen *et al.* (2008) recommend a thorough scrutiny of specific commodity chains starting from input supply, farm production, processing, marketing, support services, enabling factors and value chain barriers. Value chain mapping can be done using two approaches, which are the 'Commodity Based Approach' and the 'Activity Based Approach'. The Commodity based approach ensures that all activities under one commodity are analysed and fully described from production to consumption before a different commodity is considered (Figure 2.5). The activity based approach on the other hand describes commodities in relation to specific activities (Figure 2.5).

By working through each of the activities of each commodity chain (Figure 2.5), a value chain study analyses the key factors affecting smallholder inclusion in modern markets. Vermeulen *et al.* (2008) highlighted that the sequence and combination of the activities can also be juggled to best fit the challenges and context of a particular country or stakeholder group. By this notion, different activities may be given greater or less emphasis, or skipped altogether (Vermeulen, *et al*, 2008).

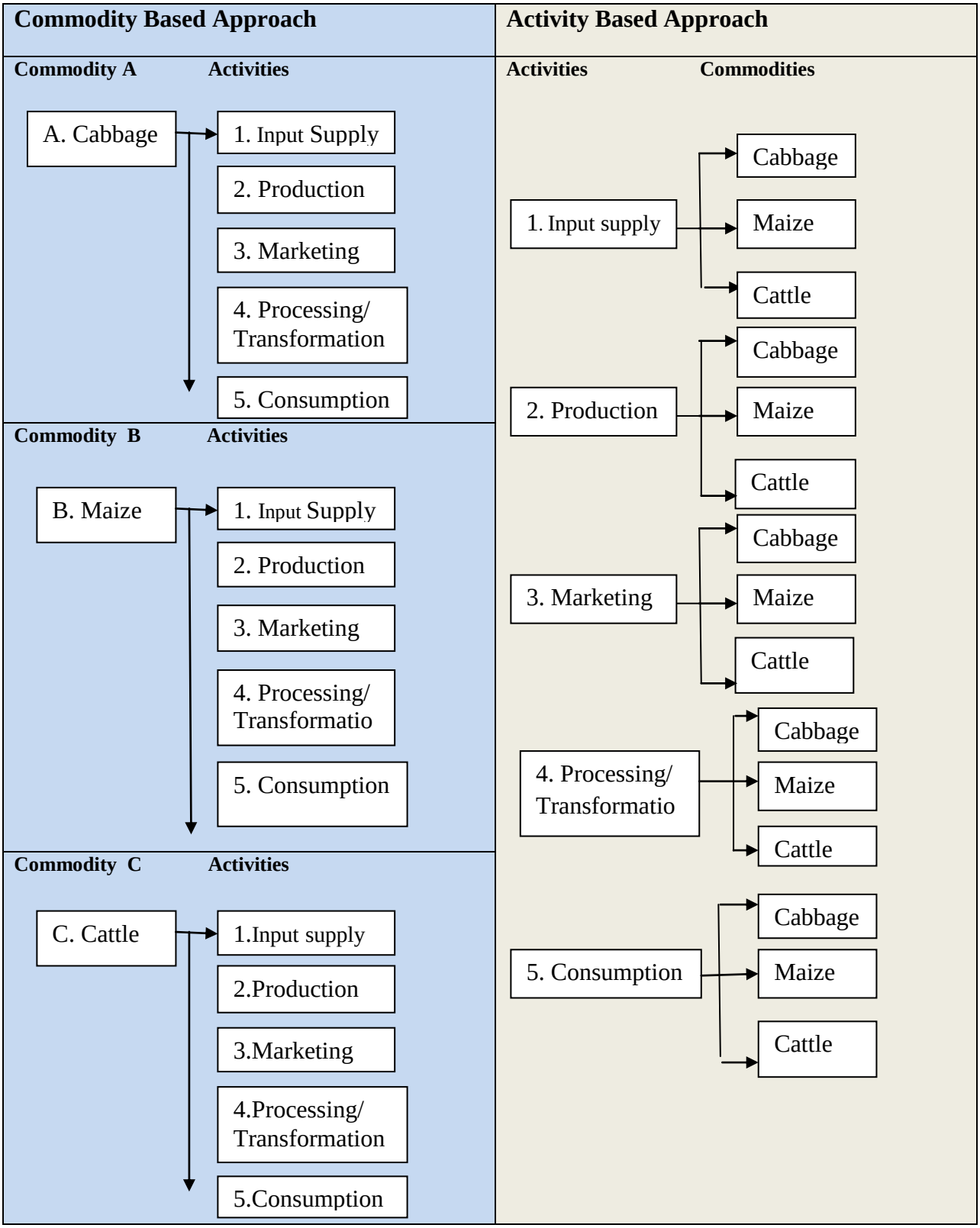


Figure 2. 5: Approaches for value chain mapping

Traditional, commodity-based competitive analyses have been a mainstay in the agricultural economics literature (Hudson and Ethridge, 2000). This approach resulted from a merging of trade theory and marketing, in an effort to ascertain the relative position of different sectors on a sector-by-

sector basis (Bredahl, Abbot, and Reed as cited by Hudson and Ethridge, 2000). From a trade policy perspective, policy makers have been concerned about the impacts of product imports on domestic industries like the impacts of soybean imports on the South African soybean industry. The commodity-based approach has been to assess competitiveness of a nation, industry or sector, through effective mapping of value chains of commodities under production analysis (Hudson and Ethridge, 2000).

With the increasing globalisation of markets, industries are increasingly witnessing the sequential manufacturing of consumer products in several countries before reaching the final consumer. To capture the consequences of globalisation fully, however, trade within vertical-value chains also needs to be considered (Hudson and Ethridge, 2000). As such, an analysis of commodity markets as if they were disconnected from their downstream products may result in misleading or erroneous conclusions (Hudson and Ethridge, 2000). However, some scholars argue that the commodity-based analysis is limited in its ability to identify the impacts of policy through a vertical-supply chain (Fabe, Grote and Winter, 2009). Thus, traditional, commodity-based competitive analysis may not detect extended impacts of policy, resulting in incomplete or mistaken conclusions (Fabe, *et al*, 2009).

2.3.3 Quantitative value chain analysis

Quantitative value chain analysis is widespread in microeconomic value chain impact assessment. It includes treatment effect and quantitative econometric models to assess the impact of food, social, and environmental standards as well as transaction costs on the income or welfare of households or countries (Fabe, Grote and Winter, 2009). Value chain analysis has also been applied to measure production efficiency of firms.

2.3.2.1 Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) is a non-parametric technique to measure technical efficiency at a point in chain. Observed input and output quantities are used to construct a production possibility space with which individual decision making units (DMUs) are compared to determine their relative efficiencies (Bowlins, 1998). DEA requires that DMUs be relatively homogeneous with the same inputs and outputs in positive amounts (Bowlin, 1998).

Sotelsek and Laborda (2010) used Data Envelopment Analysis (DEA) to measure technical efficiency of value chains in Eastern European Union Companies. DEA is widely used in agriculture as well. The Sotelsek and Laborda study focused on measurement of technical efficiency through assessing use of resources in relation to the production of goods or services of the decision making units (DMU), where the DMU represents a firm or an organization producing a certain product. Three major inputs that include labour cost, materials and energy cost were analysed together with single output expressed as sales. Sotelsek and Laborda (2010) realised that labor organisation in terms of use of temporary workers; labour disputes and education level of workers affected the efficiency of the firms. More so, value-addition initiatives affect efficiency of firms at the sector level through development of new products and expenditures on research and development.

In most studies where DEA is applied, researchers seek to measure the efficiency of DMUs and to explain the estimated technical efficiency (TE) scores using socio-economic and other production variables (Galanopoulos, Aggelopoulous, Kamenidou and Mattas, 2006).

2.3.2.2 Stochastic Frontier Analysis

According to Bekele *et al.* (2002), the basic stochastic frontier model was first proposed by Alginer, Lovell and Schmidt (1977) and Mueesen and van de Broeck (1977). Reviews on the applications Stochastic Frontier Analysis in agriculture were presented by Battese (1992), Bravo-Ureta and Pinheiro (1993) and Coelli (1995). Huang and Liu (1994) specified a neutral stochastic frontier production function, in which the technical inefficiency effects were specified in terms of various farm-specific variables and interactions among these variables and the input variables in the frontier. Battese and Coelli (1995) as cited by Mushunje *et al* (2005), proposed a stochastic frontier

production function for panel data, in which the technical inefficiency effects were specified in terms of various explanatory variables, including time.

The Stochastic Frontier Analysis (SFA) is estimated using maximum likelihood estimation techniques (Sarafidis, 2002). Mushunje, Fraser and Belete, (2005) explained the differences in technical efficiency between cotton farmers on communal and resettled land in Zimbabwe using a Cobb-Douglas type stochastic production frontier model. Chisango and Obi (2010) also applied the Stochastic Frontier Approach to estimate farm level technical efficiency. The study aimed to determine the extent to which the agricultural mechanization programme contributed to attainment of the goals of the fast track land reform programme in Zimbabwe. It also analysed the effect of variables such as land, access to irrigation, machinery ownership, livestock ownership, seed and agrochemicals, on overall farm efficiency. The results of the study showed positive relationships between key productive inputs and farm performance still hold for Zimbabwe despite current economic problems. However, the Chisango and Obi (2010) study highlighted that technical efficiency at the production level is also meaningless in the absence of enhanced market access.

The advantage of Stochastic Frontier Analysis (SFA) to non-parametric measures such as data envelopment analysis (DEA) is that it can provide an indication as to the functional form of the frontier and the significance of individual explanatory factors (Sarafidis, 2002).

2.3.2.3 Equilibrium model

Equilibrium models try to explain the numerous economic activities of different agents by use of standard assumptions on the behaviour of certain agents (Sotelsek and Laborda, 2010). The primary assumption of an equilibrium model is rationality. Walras model is considered the fundamental theory to explain the functioning of independent markets where flexible prices determine the allocation of scarce resources, and rational producers and consumers maximize profits and utility respectively (Takayama, 1985). Two major groups of models are distinguished namely the general equilibrium models and partial equilibrium models (Sotelsek and Laborda, 2010). Whilst partial equilibrium models focus on particular sectors of interest, general equilibrium models represent the complete economy determining all transactions endogenously (Sotelsek and Laborda, 2010). Computable general equilibrium (CGE) models are based on the socio-economic structure and represent mathematical models of an entire economic system that can be closed or related to external

agents via trade (Sotelsek and Laborda, 2010). The computable general equilibrium (CGE) model is also characterised by its flexible multi-product, multi-sector, multi-institution disaggregation (Sotelsek and Laborda, 2010), and as such have been developed to explain the economic performance of countries. Existing applications also cover regions or single villages, and the structure can also be applied to represent a single household. Winter et al. (2008) applied a general equilibrium model at the village level to analyze the impacts of an innovative energy value chain on land use systems and degraded forests in Kenya. A value chain analysis for different wood substitutes such as Jatropha curcas was implemented to analyze the impact of its cultivation on the consumption of natural resources, and on income distribution and food security within the village level. Combined with a game theoretical approach, simulations illustrate potential benefits of cooperative forest and community land management compared to a situation of unregulated resource competition among stakeholders in the Kakamega District of Western Kenya (Winter et al. (2008).

Partial equilibrium models represent a comparative static framework with the focus on a specific sector (Sotelsek and Laborda, 2010). The partial equilibrium models do not include all production and consumption accounts in an economy. However, the approach allows the researchers to trace the impact of changes in one market or one value chain on other markets or value chains (Sotelsek and Laborda, 2010). Partial equilibrium models are best suited to analyze sector reforms that are less likely to have large impacts on macroeconomic aggregates (Sotelsek and Laborda, 2010).Nielsen (2008) developed a partial equilibrium framework to identify welfare effects of fish trade liberalisation. The results showed that the welfare effect of trade liberalization in an exporter country is negative under open access and positive under regulated restricted access. Lundmark (2007) applied a partial equilibrium model of the forest cluster assessing the impact of changing market conditions for the sawmill industry. The focus of the study was to analyze the interdependencies between the different sectors that are dependent from the product “wood”. The results confirmed that due to dependencies between the sectors, changing market conditions in one sector could have profound effects on other sectors (Lundmark, 2007). The analysis indicated that both production and consumption patterns are sensitive to changes in the demand for sawn wood products (Lundmark, 2007).

2.4 Value chain case studies in agriculture

The following two cases reflect different situations when Value Chains Analysis has been undertaken, where the purpose and outputs have been quite diverse.

Case 1: Use of value chain analysis to improve agricultural productivity

USAID funded a programme in Zambia called Production, Finance and Improved Technology (PROFIT), which used a value chain approach to create and strengthen links between micro and small enterprises and other actors at different levels of the value chain.

The programme targeted competitive, high potential industries that included small and micro enterprises and had three components, namely (1) identifying the competitive advantage, (2) designing strategies to upgrade the industry and (3) ensuring competitive sustainability.

The scrutiny of the Zambian beef industry identified poor animal health among smallholders as a primary constraint affecting the competitiveness of the industry. Lack of private veterinary services targeting smallholder farmers, as well as the logistical challenges given their dispersed location in hard-to-reach areas, was the major cause of poor animal health. This negatively affected the whole cattle to beef value chain in Zambia and an intervention strategy was required and USAID thus facilitated the development of a veterinary services model.

In a background document on the PROFIT veterinary services initiative[2], prepared for an electronic conference, the intervention around animal health provided a sound basis to focus on increasing smallholder cattle sales because other key actors such as insurance companies and abattoirs were willing to engage with the livestock owners because of the investment in herd health. This allowed for more substantial business dialogue with these actors. While the initial focus of the programme was on addressing the herd health issue, resources were then to be allocated to other activities that would build other beef industry relationships.

These three cases give an indication of how the concept of value chain analysis can be used to obtain an overall understanding of the value chain in order to identify the point of intervention that is likely to have the greatest positive impact on the industry. According to Kaplinsky & Morris (2000), when

[2] Results Assessment Case, PROFIT Zambia Vet Services Sector (http://communities.seepnetwork.org/Results_Assessment_Conference_2009/system/files/PROFIT+RA+case+vet+services.pdf)

seeking to integrate SMMEs into global value chains, one needs to benchmark their skills and weaknesses against other firms, map their connectedness with other SMMEs (horizontal linkages) and with other firms (vertical) and analyse their connection to markets as well as their ability to keep to the 'rules' set by the stronger players.

Case 2: Use of value chain analysis to improve marketing

Knopp (2008) documented a process where a VCA was conducted by Kenya Business Development Services (BDS) to identify challenges related to the marketing of avocados. The analysis was funded by USAID and it revealed that severe misalignments in the marketing of avocados challenged smallholder farmers and inhibited competitiveness of the overall industry.

The smallholder farmers in Kenya faced numerous challenges in production and marketing their produce. For instance, the marketing of avocados was dominated by informal brokers that benefited on misinformation among market actors. Whilst prices were fluctuating daily, farmers and lead firms could not rely on when brokers would come to buy their fruit.

It is important to note that Kenya BDS facilitated the development of rural professional brokerage services to get round the existing market constraints on the avocado market. These brokerage service providers offered bulking, linkage, traceability, forecasting and food safety services for smallholders and firms exporting avocados to the EU market. This was achieved through an initial capacity-building of each firm and their related out-grower networks that led to the signing of supply contracts with designated lead exporters. An improvement on market performance was noted since the lead exporters offered guaranteed prices and markets for farmers. The involvement of Kenya BDS to improve avocado value chain performance in Kenya exposed a lot of potential for the fruit sector.

Kenya BDS also provided cost-sharing assistance to the brokerage firms during the initial season as they demonstrated their value to both farmer and buyer. During the first year of implementation, the exporter provided agrochemical spraying services, pesticide inputs, fertilizer, field agronomists, graders, pickers and transporters to 405 farmers under a pilot scheme, with the cost of each service being embedded in the final price offered to farmers for first grade fruit.

Some unforeseen challenges were however confronted during the initial phases of market intervention. Firstly, the brokerage firms' field workers had little skills to deliver their duties, and

most were on a monthly salary, leaving little incentive to maximise yields and sales. The second challenge was based on the nature of the product. Unlike vegetables, avocados are limited to one primary harvest each year, hence it was realised that, while the brokerage firms covered their costs during peak harvest, they were left with no cash-flow during the off season. Furthermore, in order to maximise their income and avoid deductions from the embedded services, some farmers began "side-selling" their fruit to spot-market brokers rather than honouring their lead firm commitments.

Based on these developments, Kenya BDS field staff responded with a series of follow-on facilitation activities to realign market signals, promote ownership and self-selection, and encourage competition among brokerage firms. Technical assistance in business strategy was provided to each of the brokerage firms to assist them to better articulate their value proposition, as well as explore additional areas for revenue. As such, this intervention resulted in a positive contribution in the whole avocado production and marketing chain. For instance, review of progress by Kenya BDS showed that each brokerage firm expanded the services offered into new yet complementary areas (e.g. provision of spraying services; brokerage services for vegetable sales). Such a realisation by the implementing agent (BDS) and the key brokerage firms was thus not only important to avocado production, but to other value chains like vegetables, thereby increasing the income base of participating farmers. This also acted as way to spread risk and cash flow improvement by farmers.

As many brokerage firms entered the seemingly lucrative business, the market moved towards a pure competitive market. This gave rise to the need for brokerage firms to aggressively market their services since selection of brokerage firms was done entirely by farmers and formalised through a service agreement. The simple coordination of these events underscored to brokerage firms the importance of value in service delivery.

This synopsis of the Kenyan avocado industry demonstrates some complex phenomenon associated with typical food value chains. No clear cut solution is available to match the ever changing environment under which farmers operate and therefore continuous improvement processes have been adopted by different organizations and donor agents to improve efficiency among farmers.

2.5 The benefits of undertaking value chain analyses

Value chain analysis has emerged as a strong agent of change. Regardless of the location of a business along a supply chain, business success depends on an understanding of and ability to respond to the needs of the entire chain (Vermeulen et al, 2008). Value chain analysis and perspective has become a central development strategy to enhance different sectors of economies. VCA is important because it allows for systematic competitiveness by identifying core competencies that are required, or which already exist and because it involves mapping the flow of inputs (goods and services) so that one can see which parties' behavior is important (Kaplinsky & Morris, 2000).

Multiple linkages of sectors within an economy can be effectively analysed and evaluated using the value chain concept (Vermeulen et al, 2008). It can therefore be argued that the use of value chain approach to inform production and processing sectors is helpful in identifying potential industries which exhibit exploitable characteristics for the objectives of the farmers and the funding organisations / financial institutions (Vermeulen et al, 2008). This is based on economic assumptions that farmers channel their produce towards the most profitable markets so as to maximise their profits, while funding organisations advocate for efficient production and marketing cycles that enable them to recover their invested incomes with interest (Vermeulen et al, 2008).

A necessary condition for profit-maximisation is that each downstream firm chooses its output so that marginal revenue equals marginal cost, where marginal revenue is its perceived marginal revenue curve. As such, a holistic value chain approach looks at both the backward and the forward linkages along the chain (Knopp, 2008).

Value chain analysis is important in detecting a very important relationship that involves changes in downstream output and labour demand / employment (Da Silva and Filho, 2007). This is very crucial in developing countries that are battling to find solutions to high levels of unemployment and very low agricultural productivity (Da Silva and Filho, 2007). Downstream value chain beneficiation allows for greater employment, particularly of unskilled workers, because downstream production is labour intensive and frequently makes use of unskilled labour (Da Silva and Filho, 2007).

VCA has also been widely used as a tool to explain the link between changes in upstream prices and downstream output, which is based on the relationship between the prices of the primary good and the final good. Price differences have always been at the centre stage when discussing smallholder markets in developing countries (Da Silva and Filho, 2007). Imperfect markets are very common in

developing countries, hence farmers are confronted with pricing dilemmas based on the little information that they have about their market. The responsiveness of downstream agricultural quantity demanded to changes in the prices of the primary commodity is dependent on a range of factors that include the elasticities of demand for the intermediate and final products as well as the market structure at each level of the value chain.

2.6 Chapter summary

The review of literature related to value chain analysis, besides affording a common understanding of this concept, also highlighted the role that this approach can play in developing various agricultural enterprises / industries. The value chain concept has evolved over time, from the 1950s when it was mainly used to explain industrial and manufacturing functions. The value chain concept has since been redefined by Porter (1985) and its broad application has since been adopted in agri-food systems. However, agriculture uses water as the major input; hence it is important to have an understanding of the current situation in terms of water availability and water usage and its implication on agricultural value chains. This highlights the importance of making more efficient use of water, given the scarcity of the resource.

CHAPTER 3

METHODOLOGY AND ANALYTICAL FRAMEWORK

3.1 Introduction

The overall objective of the study is to analyse food value chains from a farm-level production efficiency standpoint as a basis for gaining insights into how subsistence and emerging farmers can be integrated into the mainstream agricultural economy of South Africa. The chapter commences by describing the study area in relation to its geographic location, physical features and the main farming activities in the area. The chapter also describes sampling procedures, analytical framework and the overall research process of the project. The chapter presents details of the models adapted in the analysis and the data specifications of the study.

3.1.2 Geographical Location

Foundation Community Project and Ciko Santrini Community Project are situated in Mbashe local Municipality, which is under the Amatole District in the Eastern Cape Province of South Africa. It is located in the south eastern part of the Eastern Cape Province, between East London and Mthatha. It is approximately 165km from East London to Mbashe Municipality, broken down into 130km from East London to Dutywa town along the N2-Highway and a further 35km in the south easterly direction, along the R408-highway to Willowvale town. Foundation Community Project is located in Mbozi village, which is 17km East of Willowvale town, while Ciko project is 7km from Willowvale town. Other nearby small towns include Elliotdale and Butterworth. Geographically, Foundation Community Project is positioned at the following coordinates: S 32º 16' 44.1", E 28º 36" 32.4" and Ciko Santrini Community Project is positioned at the following coordinates: S 32º 14' 49", E 28º 34' 89" with an Elevation of 226m. Figure 3.1 shows the geographical location of Foundation Community Project in relation to Mbashe Local Municipality.

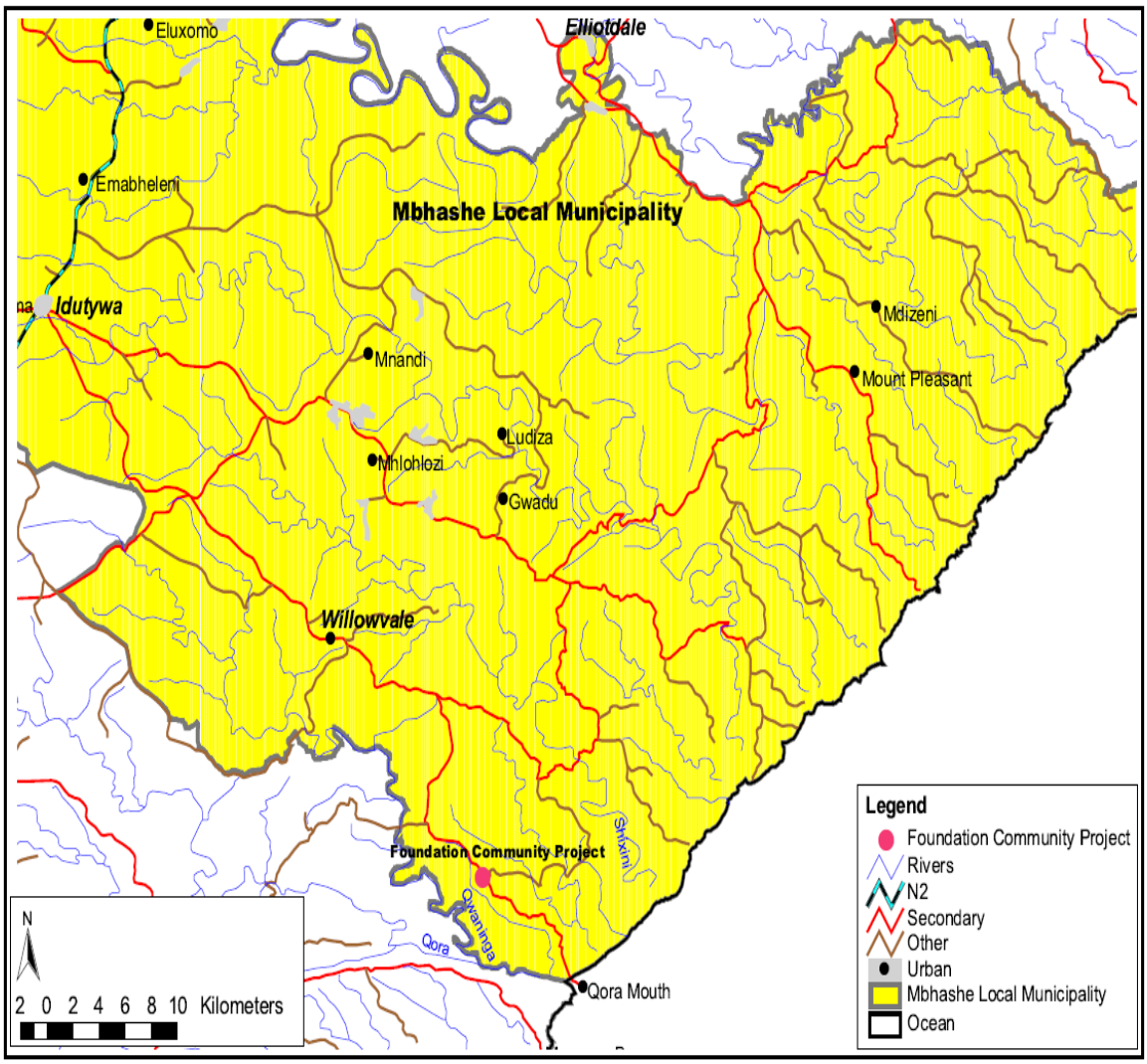


Figure 3. 1: Mbashe Local Municipality
Source: Map produced by the Institute of Natural Resources (INR), KwaZulu Natal, (2009)

3.1.3 Description of the study area

Mbozi and Ciko villages are dominated by irregular undulating lowlands with hills and average sized mountains. According to a land use study by Gubu, Habig, Jourbert, Madzivhandila, Mkhula, and Ntantiso, (2005), the low lying areas are covered with relatively deep and porous soils with favourable water characteristics, with very shallow soils on the high and steep areas. The dominant soil types are sandy loams, clay loams on sandstone and deep red or yellow clay loams with high organic matter (Gubu *et al,* 2005). The Moist Upland Grassland and Eastern Thorn Bush veld are

prevalent in the Mbashe area. Water for irrigation and livestock in the Mbozi community is directly drawn from the nearby Shixini River, Mbozi River, Gwaninga River, Ciko River and from small catchments dams in the village.

3.1.4 Historic Background

Foundation Community Project started with thirteen participating farmers in 2005 and was officially launched in 2007. Currently, five hectares is under irrigation with twenty active members working (13 women, 5 youths and 2 men) on the project. The government however allocated a total of 66 hectares to the project to allow more people to take part in the project. A total of 153 members, drawn from the surrounding communities have been registered as potential beneficiaries when the project is utilized to full capacity. However, agricultural land in the former homelands of Transkei is under-utilised, where livestock and horticulture have potential to expand (ECDC, 2006). Great efforts are going towards drawing farmers, mostly subsistence farmers, in the former Bantustans into commercial farming, as well as into moving up a notch through beneficiation of raw materials (ECDC, 2006).

3.1.5 Demographic Information

Ciko village has a total of 67 households and Mbozi Village has a total of 113 households. However, the two villages are under one headman and therefore are governed by same policies. Mbashe Local Municipality has a total land area of 305 009 hectares. The highest population density generally falls within the Wild Coast and former Transkei, with an average of between 2 100 and 3324 households per ward (Gubu *et al* 2005). Amatole District has the highest population in Eastern Cape, with 1 657 373people. It is of concern that an estimated 72% of Amatole residents live in poverty while 96% are un-employed (ECDA, 2006).

3.1.6 Settlement Patterns and Land tenure System

Mbashe local municipality falls under the Amatole District (Map 1), where it is one of the eight local municipalities in the district. Specifically, the project is based in Mbozi and Ciko villages of the

Mbashe Municipality, where land ownership is communal. Residential stands are allocated by the headman while grazing land is communally owned. The village is located on high plateau and is serviced by gravel roads. Livestock get their drinking water from Mbozi River, Shixini River, Ciko River, Qwaninga River and small earth dams constructed in the village. The village is also benefiting from piped water that is pumped by the local municipality from Qwaninga River. Homesteads are located within a maximum distance of two hundred metres from the nearest water point. Additional water for domestic use is also harvested from house roofs into storage tanks during rainy days.

3.1.7 Climate

The long term mean temperature is 18 degrees Celsius and annual rainfall range between from 801mm and 1500mm, (Maps: Appendix 2 & 3), with 60 to 75% of the rainfall being received in summer (November to April) (ECDA, 2006). Summer temperatures range from 22 degrees Celsius in higher altitude areas to 27 degrees Celsius in lower altitude areas while winter temperatures range between 3 and 10 degrees Celsius (Gubu *et al,* 2005). This represents good farming temperatures and can ensure good crop yields if this is complemented by good soils. Very low winter temperatures can result in winter frost in low lying areas (Dhar, Douangsavanh, Magoro, Koryekan, Palit and Serage, 2001).

3.1.8 General Farming Systems

Mbashe local municipality residents practice livestock rearing especially cattle, goats, chicken and sheep (ECDC, 2006). According to the South African Department of Agriculture, Eastern Cape Province has the largest livestock herd in the country with, 21% of South Africa's cattle, 28% of its sheep and 46% of its goats. Crop farming is also at subsistence level within the Mbozi village, characterised by backyard gardens and medium sized plots where terrain permits. Studies on land use patterns in Mbashe Local Municipality shows that any crop can be grown in the rich soils given the stable climate that gradually changes from temperate to sub-tropical along the coasts (Gubu *et al,* 2005). Maize however forms the dominant crop grown under rain fed system.

3.1.9 Communal/small scale farming

The communities within 20km radius of the study site (Foundation Community Project) do not practice much crop farming due to the steep terrain and mountainous environment. Dry land crop production is mainly on low lying terrain with deep rich soils. Mbashe local municipality stands as one of the local municipalities where the government launched its Green Revolution programme that supported smallholder farmers to increase food production through maximization of land under cultivation. As such several programmes aimed at increasing food production are running in Mbashe, of which Mbozi village is participating in the Siyazodla Food Production Programme. Beneficiaries of the Siyazondla Programme should own less than one hectare piece of land which is not under commercial production. The objective of the programme is to enhance food security through boosting homestead food production (ECDA, 2006)

3.1.10 Commercial farming

The nearest commercial farms that do large scale production of livestock and crops are found near East London. However, there are several medium to small scale irrigated plots that produces cabbages, potatoes, spinach and butternuts for the market. Foundation Community Project participants have not yet seen these small scale producers as a threat to their market and the project's viability. An analysis of the influence of these competitors on viability and pricing structures of the project shall be carried out in this project. On farm marketing of fresh produce to neighbors, hawkers and traders takes place at Foundation Community Project, which also has a marketing stand (Selling point) at Elliotdale where a cooperative employee sells the produce. Much of the produce goes to supermarkets in Willowvale (Gatyana), Dutywa, Butterworth and Elliotdale through retailers who come with their own transport to buy in bulk.

3.1.11 Irrigation systems

Both Ciko and Foundation Community Project pump water from Shixini River. The two irrigation schemes are under sprinkler irrigation system powered by diesel pumps and networked by hosepipes infield. The cooperatives do not pay any water rates and are not affiliated to any Water User Association (WUA). It is the responsibility of project members to hire technicians to attend to any breakdowns on the irrigation systems.

3.1.12Institutional arrangements

Ciko and Foundation Community Project are being run as cooperatives. Farmers do collective production of crops and do collective marketing as well. However, the set-up is different on livestock enterprises, where farmers raise and market their livestock and livestock products individually under extensive pasture. This is done independent of project activities.

Technical support is provided by the Eastern Cape Department of Agriculture. This involves extension, training and farming methods. Major source of funding for Ciko and Foundation Community Project is the department of social development. A total of R250 000, 00 was contributed by the Department of Social Development towards fencing, pump house, chemical storage rooms, pit latrine, guardroom and office construction at Foundation Project, while R240 000,00 was allocated to Ciko Project. Land clearing, road maintenance and construction is mainly done by Amatole District Municipality through a budget allocation to Mbashe local municipality.

3.1.13 Infrastructure

Ciko and Mbozi villages are serviced by a 17km gravel road to the nearby Willowvale town. Due to the steep terrain and high erosion levels, the gravel roads in the area require regular maintenance due to erosion. Both Ciko and Foundation Community Project have low resource endowment with each project owning a 10HP diesel pump to cater for the irrigation needs of the scheme. Water is conveyed from Shixini River through four inch aluminium delivery pipes that feed into hosepipes fitted with sprinklers to spread the irrigation water evenly across the land. Land preparation is done using a tractor. More so, there are tractor drawn equipment at the farm, which includes mould board plough,

disc harrow and a planter. While Foundation has a tractor, Ciko Project relies on hiring a tractor for land preparation from Foundation Community Project. The project sites are well fenced with barbed wire to protect crops against animal damage. A guard room was also built on site to accommodate the security personnel employed by the project to guard against produce and property theft. Some important structures at the site also include a two roomed chemical house, nursery shed and a pit latrine.

3.1.14 Enterprises

Ciko and Foundation Community Project produce a wide range of crops under sprinkler irrigation. These include Cabbage, Spinach, Butternut, Broccoli, Pumpkins, Potatoes, Green paper, Carrots and Maize. Project members decide on crops to be grown at any given time after a certain crop has been harvested or concurrently depending on land availability. A combination of four crop enterprises at any given period has usually been followed. Livestock farming is done individually by farmers to enhance their livelihoods. These include cattle, goats, sheep and chicken. Both on-farm and off –farm marketing of produce is done, as farmers try to maximize retains from their enterprises.

Given the diversity of crop enterprises being produced in the area, specific value chain analysis was conducted for cabbages and maize. On livestock enterprises, the study shall focus on cattle value chain. While crop enterprises are mainly irrigated, livestock production is done under natural pastures. Mapping and quantification of specific value chains has been performed through a scrutiny of both backward and forward linkages where primary and secondary data has been collected and analysed.

3.2 Methodology and study instruments

This section summarises the sampling methods, data collection and data analysis tools that were used during the course of the study. The study covers three specific objectives; hence three different techniques have been applied to answer specific questions of the study. The section describes the sampling procedure followed during the study and the survey instruments used to extract data at each stratum. Qualitative and quantitative data was collected and the relevant analytical techniques were used to analyse the data. Both qualitative and quantitative data analysis techniques are described in this chapter.

3.2.1 Survey data

A wide array of data sets was collected during the survey. Data pertaining to household demographics was collected to enable farmer profiling and quantification of their needs and aspirations in food value chains, as well as describing their farming systems. Production and market related data was also collected to enable value chain mapping for maize, cabbage and cattle value chains. The study utilizes both categorical and continuous data. More so, both technical and socio-economic data sets were collected from 82 smallholder farmers. Table 3.1 presents a summary of the data collected during the study.

Table 3. 1: Definition and units of measurements of key data variables

Variable	Variable Description	Value
gender	Gender of the household head	Categorical
age	Defines the age of the household head	continuous
maristat	Marital Status of household head	Categorical
farmlabo	Farm labour; represents the amount of labour available to perform agricultural work.	Continuous
edulev	Educational level of the household head	Categorical
totlandholding	Total land holding available for specific cropping activities	Continuous
plouqty	Number of ploughs as a representation of capital assets	Continuous
maizarea(ha)	Area under maize production in hectares	Continuous
maizharves(kg)	Maize yield/harvest in kilograms	Continuous
maizinpcost	Maize input costs	Continuous
enourain	Rain water perception (adequate or not)	Categorical: yes=1 or 0 if otherwise
rwht	Use of rain water harvesting techniques to improve water usage in agriculture.	Categorical: yes=1 or 0 if otherwise
maizselform	Form in which maize is sold (unprocessed or processed)	Categorical: yes=1 or 0 if otherwise
maizmarksat	Satisfaction with maize market (Yes or no)	Categorical: yes=1 or 0 if otherwise
maizprice	Maize market price	Continuous
maizerevenue	Maize revenue	Continuous
cabarea(ha)	Area under cabbage in hectares	Continuous
cabinpcost	Cabbage input cost	Continuous
cabharves(hds)	Cabbage yield/harvest (Heads)	Continuous
cabmark	Cabbage market	Categorical: yes=1 or 0 if otherwise
cabselform	Form in which cabbage is sold (processed or unprocessed)	Categorical: yes=1 or 0 if otherwise
cabmarksat	Cabbage market satisfaction	Categorical: yes=1 or 0 if otherwise
Cabprice(r.)	Cabbage price	Continuous
cabrevenue	Cabbage revenue	Continuous
cattnum	Number of cattle	Continuous
catinpcost	Cattle input cost	Continuous
cattmark	Cattle markets (1=informal or 0=formal)	Categorical: Formal =1 or 0 if otherwise
cattselform	Cattle sell form (1=live or 2= processed products)	Categorical:1=live or 2= processed
cattmarksat	Cattle market satisfaction (1=yes or 2=no)	Categorical
cattprice	Cattle price	Continuous
catrevenue	Cattle revenue	Continuous

Smallholder farmers in the area are involved in farm and off-farm activities. The influence of off-farm activities was not scrutinised in this study. Mixed crop-livestock farming is the dominant system in the area and rain fed agriculture is the main farming system in the area.

3.2.2 Sampling procedure

A multi-stage random sampling procedure was used in which the first stage involved selecting the local government areas. This was followed by the selection of the districts and finally the respondents. As such, sampling started from the site selection process, which involved random visits of irrigation projects in Eastern Cape Province. A total of nine irrigation schemes were visited as potential study sites, from which two sites in Mbashe local municipality was selected, namely Foundation Community Project and Ciko Santrini Community Project. The operational status and crop diversity was the basis for selecting the two sites. Background information about irrigation schemes was obtained from extension officers in different municipalities, before actual visit was done.

Two villages benefit from both Ciko Santrini Community Project and Foundation Community Project. These include Ciko and Mbozi villages, with 67 and 113 households respectively, making a total sampling frame of 180 households. By stratified random sampling based on village and project membership, a sample of 82 de facto heads of house-holds were chosen for the study. A structured questionnaire together with field observations and measurements was adopted for obtaining information from household respondents.

The sampled households comprised of 38 irrigation project members (active and non active) and 44 non project members. Table 3.2 presents a breakdown of the sample units from the two study sites:

Table 3. 2: Smallholder farmers - Sample Overview.

Site	**Irrigation Project Members**	**Non Project Members**	**Total**
Foundation Community Project	20	22 (Mbozi village)	42
Ciko Santrini Community Project	18	22 (Ciko Village)	40
Total	**38**	**44**	**82**

The sampling process targeted all project members (active or inactive) in all the participating communities. Non project member farmers were randomly sampled within the neighbourhood of irrigation project participants.

Random sampling was also used to sample consumers, hawkers as well retail and wholesale traders at Willowvale, Dutywa and Butterworth towns. Two fresh produce markets were also purposively sampled and these are the Butterworth Fresh Produce Market and the East London Municipality Market. Table 3.3 summarises the sample units for the consumers, hawkers and traders.

Table 3. 3: Consumers, Hawkers and Traders sample units

Category	**Sample Units**
Consumers	41
Hawkers	25
Retail and wholesale Traders	20
Total	**86**

The consumers, hawkers and traders participated in supplying marketing information that is deemed to directly or indirectly affect farmers in Mbozi and Ciko villages. As such the study has a total of 168 sample units based on categories defined on Table 3.2 and 3.3.

3.2.3 Data collection

The research relies on both primary and secondary data. Sample survey techniques were followed where enumerators are trained to administer questionnaires to the research subject.

3.2.3.1 Primary data

Primary data collection employed various tools and methods namely personal interviews, observation and focus group discussions. A structured questionnaire was designed and administered within the study area. This was mainly used to collect data from individual farmers. More so, data was collected from focus groups and farmers' associations. Regular interviews to group individuals were used to extract intrinsic information about the farmers' involvement and participation in value chains. Semi-structured interviews with key informants, based on a checklist were also used during the data collection process. Key informant interviews were performed with guides that list topics and issues to be covered. These key informants therefore represent the sampled farmers who are expected to volunteer information through participating in interviews being conducted by the data collection team. Visual tools such as pictures are also used to show real features within the study area.

3.2.3.2 Secondary data

While value chain analysis makes use of primary data obtained through formal statistical approaches, secondary sources of data are also valuable for this type of study. Statistical yearbooks, farmers' records, academic research papers, government reports, trade associations, farmers' union records and any other credible data sources were used to augment primary data.

3.2.3 Data analysis

This section seeks to answer the major objectives of the study, whose aim is to profile food systems broadly to understand their nature, constraints and opportunities in relation to water as a production input for both rain-fed and irrigated agriculture. Data analysis techniques adopted shall give a detailed coverage of the farmers needs and aspirations , mapping of cabbage, maize and cattle food value chains as well as an analysis of the determinants of production efficiency at farm-level. Table 3.4 presents a summary of the objectives and the analytical tools used in the study:

Table 3. 4: Summary of study objectives and analytical tools.

Objective	Analytical tool
1. Assessment of the needs and aspirations of smallholder farmers in agricultural food value chains.	1. Descriptive statistics 2. Cross tabulations and Non Parametric Correlation Model (Pearson's correlations)
2. Profiling and mapping of food systems broadly to understand its nature, constraints and opportunities in smallholder rain-fed and irrigated agriculture.	3. Commodity based approach to value chain analysis.
3. An assessment of determinants of technical efficiency for smallholder food value chains.	4. Stochastic Frontier Analysis (SFA)

3.2.3.1 Commodity based approach to value chain profiling and mapping

Value chain mapping and profiling relied more on both qualitative and quantitative data. The study adopted Kaplinsky & Morris (2000)'s guidelines on performing a commodity value chain. As such the following procedure was followed during the mapping process:

- Identifying the point of entry: - the study identifies farm level as the entry level for cabbage, maize and cattle value chains. Mapping forward linkages to processors and their customers and backwards to input suppliers was then done for commodities under study.

- Mapping the value chain: - this involves gathering data from key respondents at each link in the chain and preparing input-output relationships and identifying gross output values, net output values, flow of services and skills, employment and destination of sales.
- Identifying the product / market segments and critical success factors (CSFs) for each segment commodity.
- Identifying how producers access final markets:– identifying key buyers and charting the CSFs that they exercise

- Mapping governance: – involves looking at power / level of influence of actors in terms of their share of chain sales, value added, buying power as well as the identification of those players that 'make the rules' and those that have to keep to them
- Investigating 'upgrading' along the chain :– this is the process whereby firms or actors innovate at a rate greater than their competitors in order to be competitive and successful
- Investigating distributional issues: – this analysis involves both power, balance of leverage of different parties and income returns that accrue to different parties. The distributional issues involve obtaining data on value added at each stage in the production of a good or service (Kaplinsky and Morris 2000).

3.2.3.2 Cross tabulation and correlations

Cross tabulation is a type of a bivariate analysis that involves testing whether a relationship or an association exists between two variables (Norusis, 2004). Cross tabulation presents tests of association, directional and symmetrical measures (Norusis, 2004).

For purposes of estimating value chain participation by farmers to address household food security, non parametric correlation was used to establish whether there exists a relationship between several factors. Specifically, the two-tailed Pearson's Correlation Matrix was computed which provides correlation coefficients that indicates the strength and direction of the linear relationships between variables. The approach was used to estimate the possible correction between residential village of farmer, irrigation project membership, incomes sources, major goal of farming, production aspiration and marketing aspiration.

3.2.3.3 Stochastic Frontier Analysis (SFA)

The study adopted the stochastic frontier production functions, of the Cobb-Douglas type, proposed by Batttese and Coelli (1995), Mushunje et al (2003), Tchale, (2009) and Chisango and Obi, (2010). Production functions were estimated for the sampled farmers of Mbozi and Ciko villages. The Cobb-Douglas model is given in terms of maize, cabbage and cattle output, involving input variables and explanatory variables for the inefficiency effects in the stochastic frontier.

According to Tchale (2007), the Stochastic frontier assumes a deterministic production frontier (for example the Cobb Douglas type function) generally given by the equation:

$Q_j = f\ (Xij;\ \beta)$…….. (1)

where:

Q_j is the total output of the j^{th} farm (household) using a set of i^{th} complementary inputs,

β denotes the vector of parameters to be estimated, and

It is possible to derive technically efficient output level *Q* for any given level of inputs by substituting the *Xij* with the technically efficient inputs quantities.

The cost frontier can therefore be expressed as:

$K = h\ (P, Q;\ \gamma)$ …… *(2)*

where:

K is the minimum cost to produce output level *Q*,

P denotes the vector of input prices and

γ is a vector of the parameters to be estimated (unknowns).

The system of minimum cost demand equations can be recovered by differentiating the equation in (2), which is referred to as the cost frontier, with respect to *P* by applying Shephard's Lemma. This can be presented as given below:

$\delta K/\delta P_i = X_{ij} = l\ (P, Q, \theta),$ ……*(3)*

where: θ denotes the vector of unknown parameters.

By substituting the input prices P and the technically efficient output level Q into equation (3), we can obtain economically efficient input quantities X_s. Given these technically and economically efficient input bundles, it is now possible to calculate the actual cost of observed input levels by their respective prices as *Xi.Pi* in the case of economic efficiency (EE). It can therefore be deduced that:

Technical Efficiency (TE) $= X_i.P_I / \Sigma[(X_i.)\ P_i]$ …… (4)

Economic Efficiency (EE) = $X_s.P_s / \Sigma(X_s.P_s)$ ……*(5)*

It is important to note that economic efficiency (EE) is a product of technical efficiency (TE) and allocative efficiency (AE).

This means that AE = EE/TE …… (6)

Technical efficiency is the ability of the firm or farm to maximize output for a given set of resource inputs. Technical efficiency is the farmer's ability to produce on the maximum possible frontier (Tchale, 2009).

The parametric measure of efficiency takes a translog functional form. Following Battesse and Coelli (1995), the translog specification is mathematically expressed as:

$$\ln(q_j) = \beta_0 \sum_{i=1}^{n} \beta_i \ln(x_{ij}) + \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=i+1} \beta_{ij} \ln(x_i) \ln(x_j) + \nu_j - \mu_j \quad \text{..... (7)}$$

where:

q_j is the total output value obtained by the farm household per season,

x_{ij} is a vector of inputs used to produce output $q_j \geq 0$

$\beta_0 \ldots \beta_1$ are the parameters to be estimated,

ν_j is a two-sided random error and is assumed o be identically and independently distributed with zero mean and constant variance, and is independent of the one-sided error, υ_i.

Estimates of the cost frontier is obtained by estimating a stochastic cost frontier where the natural log of total cost K, is regressed against the natural log of specific input prices/wages. The one-sided technical efficiency effect related to the exogenous factors (z) that influence crop or animal production can be specified as:

$\upsilon_i = f(z) + \varepsilon$

where: *z* is a vector of determinants of technical efficiency and,

ε is the error assumed to be *iid* (independent and identically distributed).

The determinants are specified as household socio-economic characteristics and selected technical variables that are known to influence farm-level efficiency. Most studies found that household

variable such as household size, gender, and education level positively influence farm-level efficiency through availability of labour and its productivity (Tchale, 2009).

Analysis of efficiency in this study focused on household level of production, which represents a typical family decision making units (DMUs). The key variables at this level include land under production in hectares, yield levels/output, family and hired labour, input cost (seed & fertilizer where applicable), output prices, asset ownership (ploughs where applicable) and human capital as measured by education level. The frontier analysis defines the maximum feasible output in an environment characterized by a given set of random factors. The ratio of the observed output to the frontier is taken as a measure of its relative efficiency (Tchale, 2009). The estimation for the efficiency model is conducted in STATA[3] 10.

3.4 Chapter summary

The study was conducted in Mbozi and Ciko villages in Mbashe Local Municipality of Eastern Cape. Household questionnaires were administered in Mbozi and Ciko villages. Consumers and agricultural commodity traders in Willowvale Town, Dutywa, Butterworth and East London were also interviewed. A total of 168 participants were sampled in the proportion of 82 smallholder famers, 41 consumers, 25 hawkers and 20 agricultural commodity traders. Descriptive statistics were used to profile household characteristics while the commodity based approach was used to map the cabbage, maize and cattle value chains. The stochastic frontier analysis was used to explore the determinants of technical efficiency of food value chains at farm level. Data analysis was done using a combination of Microsoft Excel, Statistical Package For Social Scientists(SPSS 18) and STATA 10.

[3] STATA is a data analysis and statistical software package developed in 1985 by Statacorp.

CHAPTER 4

FARMERS' NEEDS AND ASPPIRATIONS IN FOOD VALUE CHAINS

4.1 Introduction

The objectives of the study were to collect basic quantitative and qualitative information about livelihoods and farming systems in selected villages of Mbashe Local Municipality, where the findings of the study would give baseline information on farmers' needs and aspiration in agricultural production and their subsequent participation in value chains. There is need to capture farmer involvement in any or both of the two basic types of agriculture, that is, irrigated and rain fed, as well as broadening the scope to cover both crop and livestock enterprises. A well established characteristic of farming is the large variation in efficiency observed on individual farm holdings, in terms of such factors as size of farm, labour and capital inputs (Chisango and Obi, 2010). Bembridge, (1986), noted that most farm management studies exclude the important dimension of the human element, which is a key factor in agricultural development. Land, technology and capital are important, but, to be fully utilised, these resources must be developed, organised and operated, since optimum productivity depends on rational decision making, which, in turn, depends on the personal and socio-psychological characteristics of the farming population, a dimension which has received little attention in former Transkei and other less developed countries of southern Africa (Bembridge, 1986).

Besides socio-economic challenges being faced by farmers in South Africa, the Eastern Cape Province's 2006 -2009 strategic development plan highlighted a serious backlog of infrastructure in the agricultural sector (Eastern Cape Department of Agriculture, 2006), where the level of infrastructural services being provided is currently inadequate to match up with the rate of Provincial infrastructure development demand. The strategic plan also stated its major objectives of infrastructural development as aimed at promoting:

• Viable commercialization of irrigation schemes

• Support agricultural production and agro processing

• Commercialization of small units

• Commercialisation of livestock production

• Sustainable management of agricultural resources

Smallholder farmers in developing countries are characterized by scarce and diminishing resources, weak human capital, lack of organizational support and inadequate infrastructural support. This therefore is the basis for this study, to quantify the communities' human capital as well as articulating their goals and aspirations in agricultural value chains.

4.2 Descriptive Analysis of household variables

This section analyses and discusses the findings of the field survey that was contacted in the Mbozi and Ciko communities of Mbashe Local Municipality in 2010.The data under analysis was collected from 82 smallholder farmers. The section gives a brief overview of demographic characteristics of the sampled households and further discusses socio-economic aspects that affect farmers' participation in agricultural activities. Results are presented using descriptive statistics, frequency counts and percentages supported by graphical presentations.

4.2.1 Demographic characteristics of sampled households.

Household demographics play a pivotal role in determining the behaviour of household farmers. As such, a set of household variables were analysed and quantified for both Ciko and Mbozi villages (Table 4.1)

Table 4. 1: Summary of demographic variables (N=82)

	Mean	**Std. Deviation**	**Min**	**Max**
Household Head gender	Male=34% Female=66%	0.477	-	-
Age of Household Head	55.156	15.156	18	80
Household size	5.04	2.202	1	10
Members who work in the field	2.01	1.374	0	7
Member fit for agriculture work	1.95	1.540	0	9
Members who are sick	0.12	0.427	0	3
Old members	0.25	0.582	0	4
Family Infants	1.80	1.427	0	5

Source: Survey data, January 2010

The 82 randomly sampled households were made up of 34% males and 66% female respondents, who were the household heads (Table 4.1). The sample, whose age ranged from 18 to 80, had an average age of 55.29 years. The household heads' age can be used as a proxy to explain the farmer's experience in farming. Age of the household head is a very crucial factor since it reflects whether the household benefits from the experience of the older person or has to base its decisions on the risk taking attitudes of younger farmers (Makhura and Mokoena, 2003 in Mkhori, 2004).

4.2.2 Marital status

The marital status of the respondents are presented in Table 4.2, and the four main groups are single, married, widowed and divorced.

Table 4. 2. Household marital status

	Frequency	Percent
Single	14	17.1%
Married	36	43.9%
Divorced	3	3.7%
Widowed	29	35.4%
Total(N=82)	82	100%

Combined survey data for both Ciko and Mbozi communities show that 44% of the respondents are married, while widows constitute 36%, single parents who never got married (17%) and/or divorced (4%). The trends in marital status of household head are very critical in African societies, where it determines stability of families. It is believed that married household heads tend to be more stable in farming activities than unmarried heads, and consequently affect both agricultural production and marketing patterns (Musemwa, 2008). However, further scrutiny of the relationship between marital status and farmers' participation in agricultural activities is required.

4.2.3 Educational level and employment status of respondents.

Education level attained by the household head relates to the human capital and the ability to cope with modern farm decision making processes. Mather and Adelzader, (1998) noted that people with higher educational attainments are more able to interpret agricultural information. It can therefore be assumed that the ability to appreciate agricultural market trends can be a strong driving force towards output maximization by smallholder farmers. Figure 4.1 gives a profile of the household educational levels to show the general literacy levels in the area.

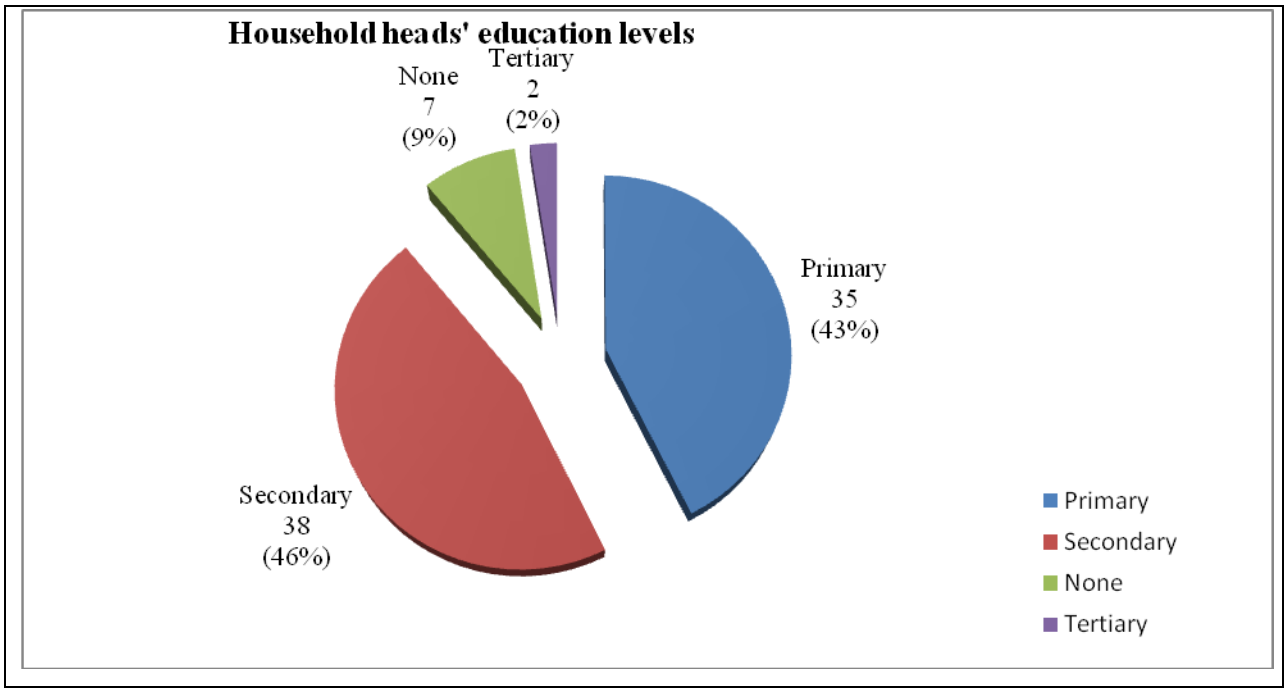


Figure 4. 1: Household heads' education level

The data indicate low skills base due to a small percentage (2%) of household members who hold a tertiary qualification (Figure 4.1). However, literacy rate for the household leaders in the community is high at 91%, with individuals having attended primary education (43%), secondary education (46%) and tertiary education (2%). Lack of professional skills can also be linked to the employment levels in the communities (Figure 4.2).

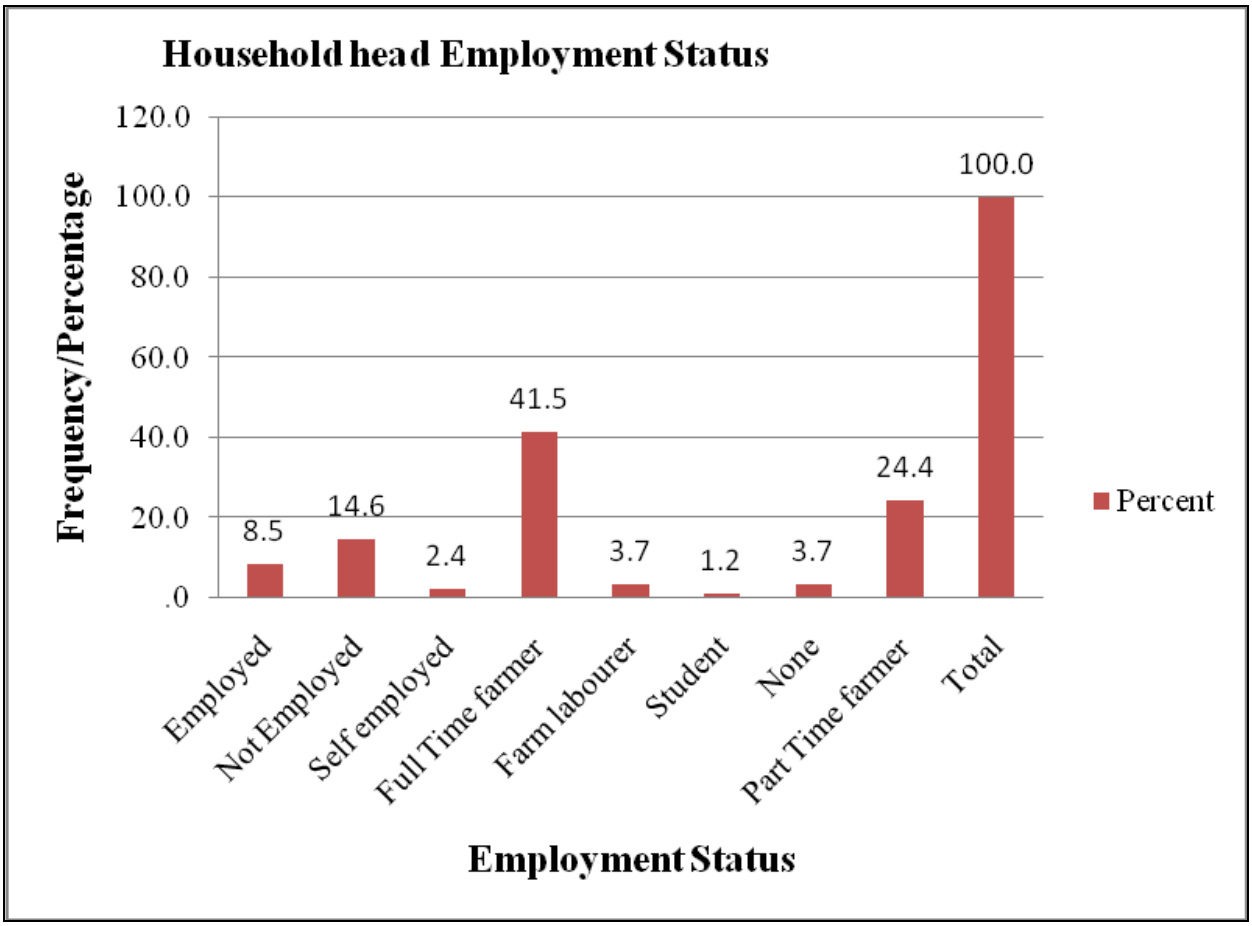


Figure 4. 2: Household head employment status

More than 40% of household heads are full time farmers and less than 3% are self employed (Figure 4.2). The need for life skills to improve the welfare of the communities through self help projects can be an important dimension to be considered. The level of unemployed villagers (14.6%) indicates a need for labour intensive projects in the communities to absorb the surplus labour.

4.2.4 Household Size and farm labour availability

Availability of labour to carry out labour intensive agricultural operations is greatly influenced by household size, hence a need to characterize Ciko and Mbozi villages in this respect (Table 4.3)

Table 4. 3: Profile of household human capital (N=82)

	Mean	Std. Deviation	Minimum	Maximum
1. Household Size	5.04	2.202	1	10
2. Number of household members who perform agricultural operations	2.01	1.374	0	7
3.Chronically sick household members	0.12	0.427	0	3
4.Too young to work in farming	1.8	1.427	0	5
5.Members of the household who are too old to work in agriculture	0.25	0.582	0	4

Out of the 82 sampled households, the minimum household size was one (1) and the maximum was ten (10), with an average of 5 members per household. The mean number of agricultural workers per household is two (2), with a minimum of zero (0) and a maximum of seven (7). The major challenge is the fact that households have more dependants than economically active members who are not directly contributing to the production system. This might lead to serious food insecurity within communities in the long run. The modal number of members who are fit to perform agricultural related tasks is one (1), who in most cases is the household head or just the owner of the household agricultural project which is supposed to benefit the whole family.

Larger household size discourages selling of farm produce because the household needs to meet its consumption demand before they decide to sell surplus produce for cash. A further challenge arises where the household is comprised of either very old or very young members who cannot assist with farming operations. Such a scenario is witnessed in Mbozi and Ciko villages were marketing of agricultural produce is very minimal and high dependency (young, old, sick and the unemployed who are not willing to work in farming) characterizes the two communities.

Figure 4.3 below shows the breakdown of agricultural activities as performed by different household members. It clearly depicts how gender and farm operations are related.

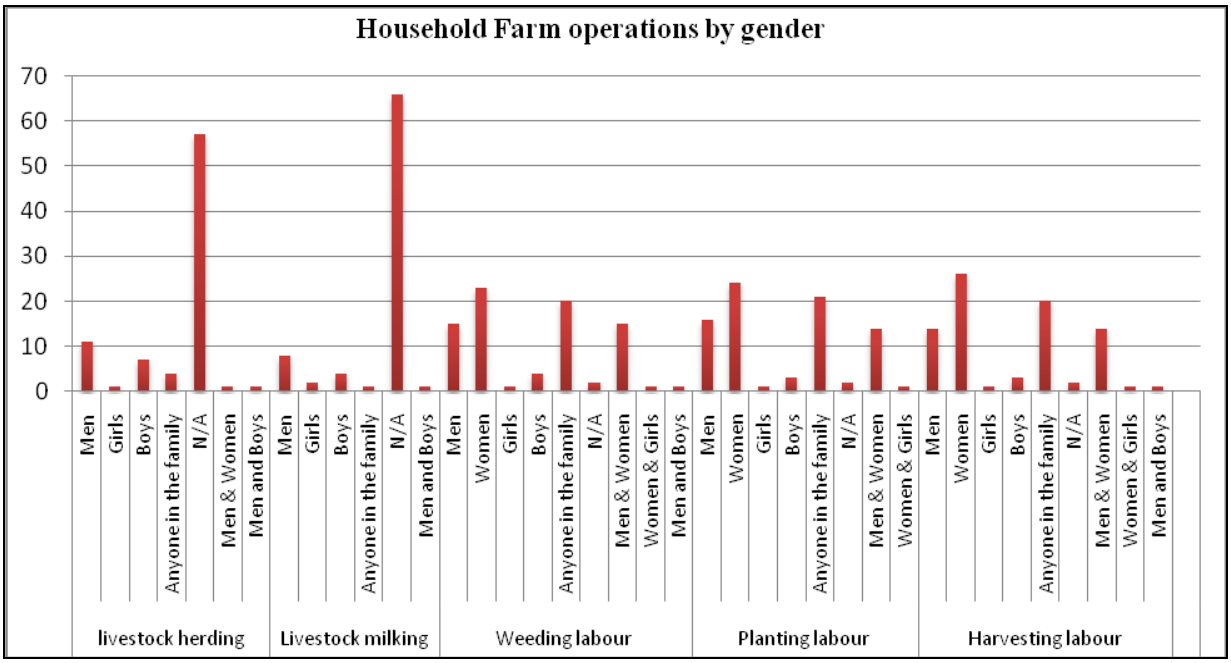


Figure 4. 3: Household farm operations by gender
Source: Survey data; January 2010

Figure 4.3 shows that women are dominating in crop production operations (crop harvesting, planting and weeding) than in livestock operations like herding and milking. The communities also rely more on family labour than hired labour (Figure 4.4).

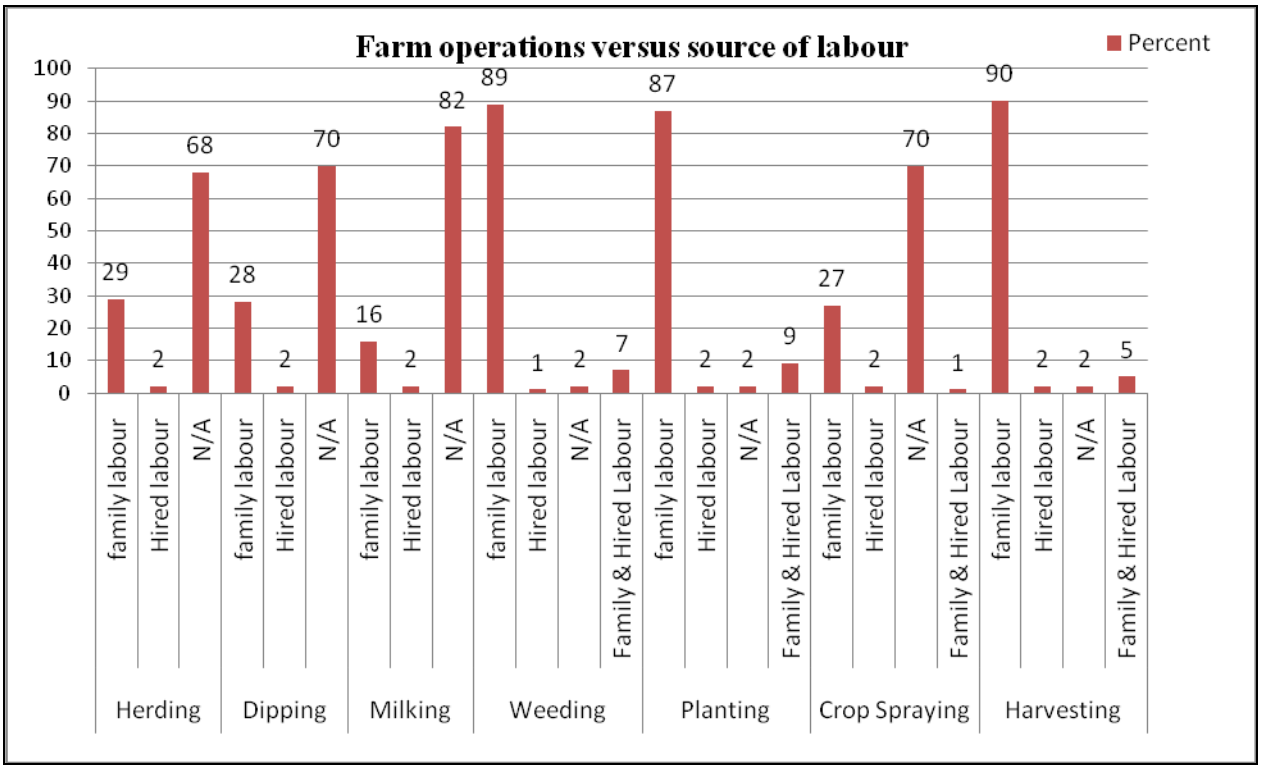


Figure 4. 4: Sources of labour for different farm operations
Source: Survey data; January 2010
N.B: N/A on the graph shows that the household is not taking part in a particular activity.

While livestock production in the study area solely depends on family labour, there is a mixture of hired and family labour for crop related operations (Figure 4.4). This could be due to scale of livestock production in the area, while crop production demands timeliness to benefit from short rain season in South Africa.

4.2.5 Farmer training

Training in agricultural technical skills remains a critical function of human capital development. This factor is however not getting attention in both communities. Villagers believe that government extension officers only offer much help to cooperatives and not individual farmers. This was revealed by training gaps in almost all farm operations that included herding, dipping, planting and crop spraying. Most use their own experience to perform operations, but this has greatly affected critical operations like crop spraying. Survey data showed that farmers do not spray chemicals to protect their crops from pest damage due to lack of knowledge and resources as well. This compromises farmers' yields and quality, and consequently their participation in markets.

4.2.6 Household major sources of income

The respondents were required to list their sources of income and amount of income obtained from each source. Table 4.4 below shows the various income sources for the Ciko and Mbozi communities.

Table 4. 4: Village of origin and household income sources

VILLAGEOF ORIGIN	HOUSEHOLD INCOME SOURCES							Total
	No Income	Family remittances	Casual labour	Government grants	Spaza shop	Casual labour & grants	Agriculture	
Mbozi (n=42)	2.3%	7.1%	9.5%	81%	0.0%	0.0%	0.0%	100
Ciko (n=40)	0.0%	12.5%	2.5%	80%	2.5%	2.5%	0.0%	100
Total (N=82)	1.2%	9.8%	6.1%	80.5%	1.2%	1.2%	0.0%	100

Source: Survey data, January 2010

It is important to note that villagers in both communities are not getting income from agricultural activities due to limited production. Approximately 81% of the households indicated that their major income source is the government grant (child, disability and old age grants). In both communities, people earn an income which is not quantified by getting involved in crop and livestock production. Such a lack of realization by communities on the role of agriculture in income generation can negatively impact strategies towards agriculture development and poverty eradication among rural dwellers. The data captures revenue from dryland or outside field cultivation and homestead gardens. There is actually some form of agricultural commodity trading in the village but the revenue is so little that most homesteads do not record it as part of their household incomes.

4.2.7 Access to agricultural assets

Households generally had few agricultural assets. Those most commonly mentioned were shovels and hoes and respondents from 67% and 96% households said that they had access to shovels and hoes, respectively. Forty-eight percent of the respondents indicated that they had access to wheelbarrows and ten percent said they had access to ploughs (with 6 having own ploughs and 2 indicating that they borrowed ploughs).

4.2.8 Land use and land tenure.

Smallholder farmers in general rely on tilling the land at various scales of operation to fulfill different household objectives. Expectedly, land owned by individual households varies in size and intensity of farming operations, which has a direct link to the households' livelihood (Table 4.5).

Table 4. 5: Land ownership and utilization patterns.

Land Type	**Mean (ha)**	**Proportion of area utilised (%)**	**Households with fenced agriculture land (%)**	**Ownership /Tenure system**
Home Garden N=80	0.71	100	84.1	Dominant tenure is traditional ownership, through allocation by local leadership. No title deeds are owned by individual famers.
Dry land (Crop land/fields) N=21,	2.76	0	0	Dominant tenure is traditional ownership, through allocation by local leadership. No title deeds are owned by individual famers.
Individual Irrigation Plot	0	0	0	No farmer owns an individual irrigation plot.
Grazing Land N=82	Not known	100%	0	All farmers benefit from the communal grazing system in the area.

Homestead gardening form the major activity in the Ciko and Mbozi communities. All villagers have at least a piece of land within their homestead for farming purposes, with a combined average of 0.71ha per household. Survey data (Table 4.5) shows that all household utilise all their homestead gardens with 84% of the household indicating that their gardens are fully fenced, while the remaining 16% of the households have their gardens partly fenced or not fenced at all.

For the 26% respondents who indicated that they had dry land fields, the average field size was 2.76ha per household. This is a small hectarage given the low yield levels of less than 3 tonnes/ha from dry land crop farming in South Africa. Dry land farmers therefore are expected to maximize output volumes by putting more hectarage under cultivation. It's also deplorable to note that even those famers with these extra fields, more than 95% are no longer cultivating their land, citing factors like lack of inputs, draught power erratic rainfall and lack of will.

Household irrigation plots are not part of the communities system of farming. There is no household with an established garden under irrigation. The only access to irrigation facilities in the community is through participating in Ciko Santrini Community project or Foundation community project. Again, lack of resources and knowledge was cited as the major deterrent factor to irrigation development in communities. The terrain of the area has also placed most household at considerable distance to the nearest river (Shixini River), hence, even bucket irrigation system is not practiced, especially in Mbozi village.

Grazing land is communally owned in both Mbozi and Ciko villages. Usage of grazing land is not restricted and all villagers benefit through unrestricted access to the resource. The challenge in both communities are steep slopes that are not favourable for livestock production especially sheep. More so, the size of grazing land is not well documented hence issues to do with stocking capacities, which are meant to preserve pastures and reduce environmental degradation are not put into practice. However, this might not affect the community in the short run given that only 18.3% of the respondents indicated that they had grazing livestock, hence pastures might not be currently overgrazed. The grazing land was also found not to be fenced, which has caused a lot of outcry from crop farmers who lose greatly due to crop damage by stray animals.

While land owned by individual farmers is small, there are no signs of the need for extra land by the community members. This is supported by the fact that none of the households is utilising the dry land fields in the area, and the willingly volunteering of fields for co-operative farming (Foundation community Project), to which the majority are not members. By land holdings, farmers in Mbozi and Ciko villages are pure subsistence farmers, who are characterised by low output per hectare and very low agricultural commodity marketing taking place. No farmers have reached emerging or commercial levels at individual household levels.

4.2.9 Water resource

Water availability for both domestic and agricultural purposes is one of the key elements in determining the habitability of an area. While rain water is critical for crop and animal production, perennial rivers and dams are very important for sustainable domestic water supply in any community. However, increase in population, climate change and increased industrial and agricultural usage of water has created an ever increasing demand for the scarce resource. A survey in Mbozi and Ciko communities established varying levels of understanding by the communities with regard to water situation in their area(Table 4.6).

Table 4. 6: Community opinion on water availability and usage

	Is rain water adequate for crop production		**Use of Infield water harvesting techniques to improve water usage**	
	Frequency	Percent	Frequency	Percent
Don't Know	2	2.4	2	2.4
Yes	33	40.2	4	4.8
No	47	57.3	76	92.7
Total	82	100.0	82	100.0

Source: Survey data, January 2010

The survey revealed that 57% of the respondents believe that the rain water they receive in the area is not adequate for sustainable agricultural production; while 40.2% are convinced that rain water was adequate (Table 4.6). The long term mean rainfall for Mbozi and Ciko villages ranges between 999mm and 1023mm (see rainfall map on study site report). The rainfall average is fair to allow crop production. Though from an agronomic stand point, the average rainfall received can support a wide rand of crop enterprises, the major challenge in Willowvale could be consistence, distribution and timeliness of the rainfall regimes, which can delay or come sooner, thereby affecting crops. The issue of drought also needs to be considered as a major factor that authorities need to tackle through promotion of irrigation schemes.

Although communities realized the shortage of agricultural water, only 4% use rain water harvesting techniques to preserve moisture, where mulching is the most common method of conserving ground moisture for crop production. Rain water harvesting is very common for domestic uses, by using tanks that collect water from house roofs. Farmer training on agricultural rainwater harvesting and conservation techniques needs to be initiated in the community to increase water productivity in the long run.

Livestock get their drinking water from Mbozi River, Shixini River, Ciko River, Qwaninga River and small earth dams constructed in the village. The village is also benefiting from piped water that is pumped by the local municipality from Qwaninga River. Homesteads are located within a distance of two hundred meters from the nearest water point. Additional water for domestic use is also harvested from house roofs using storage tanks during rainy days.

The perennial Shixini River also plays a pivotal role in supplying domestic water to the communities when there is interruption of domestic water supply, as villagers use buckets to draw water from the river for home use. Figure 4.5 presents all the sources of drinking water for Ciko and Mbozi communities.

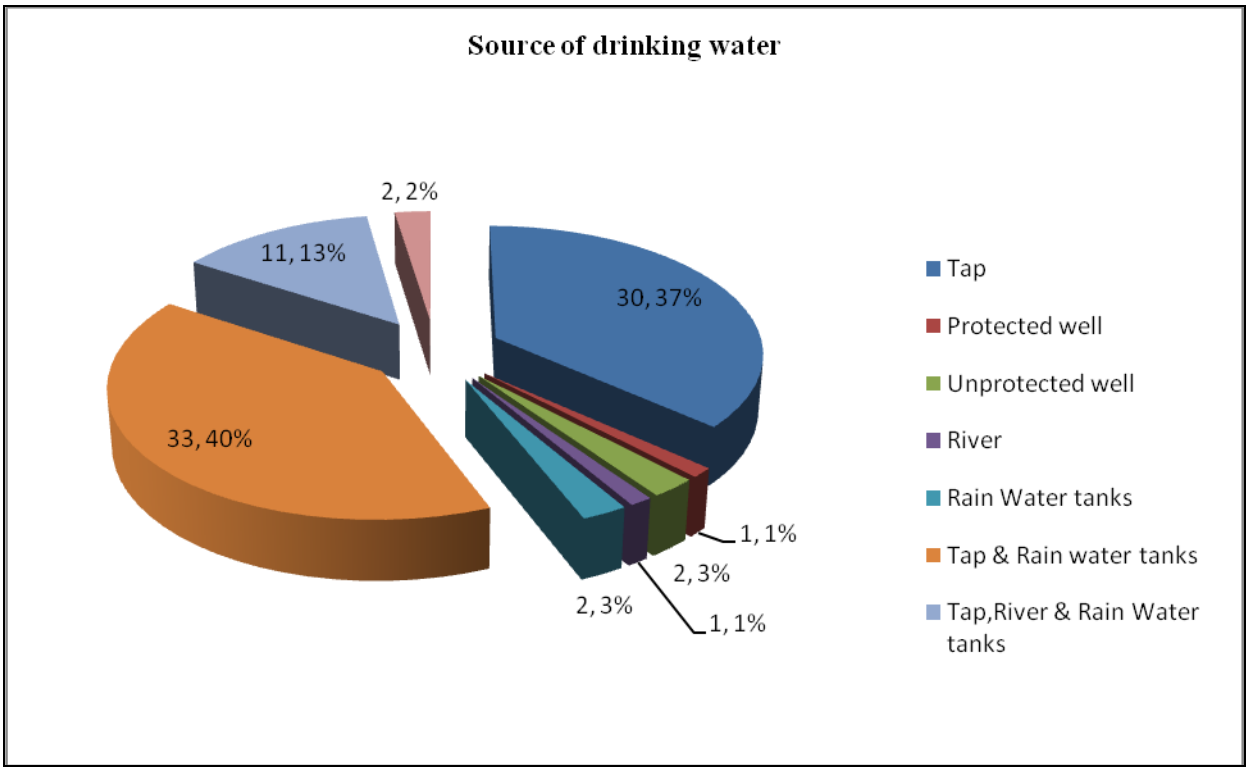


Figure 4. 5: Sources of drinking water in Mbozi and Ciko communities
Source: Survey data, January 2010

The two communities have access to domestic water, with majority of the households using more than one source of drinking water (Figure 4.5). The dominant sources are piped water /taps and rainwater tanks. However, households are exposed to unsafe water sources like rivers and dams when there is interruption in treated water supply. The survey also revealed that the Mbozi community had no clean water from November 2009 until January 2010, due to a pipe burst along the main delivery line. For all this period, residents were getting their water from nearby Shixini River, small dam and tributaries that lead to Shixini River.

4.2.10 Household goals and aspirations in agricultural participation

The driving forces in agricultural participation by farmers are the individual goals and aspirations. Table 4.7 gives a summary of famers' goals and their willingness to increase production in their respective crop enterprises.

Table 4. 7: Summary of farmers' goals and aspirations in crop farming

Farmers' goals in crop production	Frequency	Percent (%)	Cumulative Percent
Not farming	2	2.4	2.4
Marketing	0	0	2.4
Consumption	74	90.2	92.7
Marketing & Consumption	6	7.3	100.0
Total	N= 82	100	
Farmers Aspirations in crop production			
Not farming	2	2.4	2.4
Not willing to increase production	34	41.5	43.9
Willing to increase production	46	56.1	100.0
Total	N= 82	100.0	

The results depicted in Table 4.7 shows that, farmers in the two communities as subsistence. Of the 82 households interviewed, 78 households grow crops (various combinations of maize, beans, potatoes and cabbages). All 82 households said that they have home gardens (average size 0.7ha); while only 21 households indicated that they have access to cropping fields (average size 2.76ha).

Ninety per cent (90%) of the crop famers in both communities produce for consumption, with 7% producing for both marketing and consumption. None of the respondent farmers produce specifically for the market, and hence their categorization as subsistence farmers. Crop sale by farmers is not planned prior to production, therefore; agriculture is not regarded as an income generating venture at household level. While 42% of the respondents were satisfied with their production level and therefore not willing to increase production, an encouraging 56% could see the opportunity to increase the scale of crop production. Most villagers cited that their current

harvests was not enough to take them to the next season hence a need to produce more for food security reasons.

Table 4.8 presents the goals of the farmers in crop production in relation to membership to an irrigation project.

Table 4. 8: Influence of irrigation project membership on household crop enterprise goals

Irrigation Project Membership	**Major crop enterprise goals**				Total
	No Crops	Consumption Only	Marketing + Consumption	Marketing only	
Non- Members	1	43	0	0	44
Members	1	31	6	0	38
Total	2	74	6	0	82

Source: Survey data, January 2010

It is important to note that both project members and non-project members do not farm for "marketing only" at their individual homestead plots (Table 4.8). Of the 6, who at least mix consumption and marketing goals, they are all project members. It is not however clear whether their goal is influenced by their participation in irrigation projects.

4.2.10 Livestock ownership in Mbozi and Ciko communities

Though there is a limited number of livestock in the communities, there is some livestock diversity as farmers/households own more than one type of livestock at a time (Table 4.9).

Table 4. 9: Livestock ownership among households

Categories of livestock	No. of households (N)	Number of households (%)	Mean flock/herd size (min and max size)
Chickens only	23	28.0%	10.91 (2 – 56)
Cattle only	10	12.2%	4.81 (1 – 15)
Goats only	2	2.4%	9.15 (2 – 25)
Chickens and cattle	3	3.7%	
Chickens and goats	3	3.7%	
Goats and cattle	1	1.2%	
Chickens, goats and cattle	7	8.5%	
No livestock	33	40.2%	
TOTAL	**82**	**100**	

Source: Survey data, January 2010

While 40% households indicated that they had no livestock at all, 28% households indicated that they kept chicken only at their homesteads (Table 4.9). Chicken rearing can therefore be regarded as the most dominant livestock activity in the two communities. This is also supported by the percentage distribution of households with specific livestock types (Table 4.9).

Table 4.10 presents farmers goals and aspirations in livestock production.

Table 4. 10: Farmers' goals and aspirations regarding livestock production

Farmers' goals in livestock production	Frequency	Percent (%)	Cumulative Percent
No Livestock	33	40.2	40.2
Cultural Purposes	3	3.7	43.9
Consumption	36	43.9	87.8
Marketing & Consumption	10	12.2	100.0
Marketing	0	0	100.0
Total	n= 82	100	
Farmers Aspirations in livestock production			
No Livestock	33	40.2	40.2
Not aspiring to increase production	8	9.8	50
Aspiring to increase production	41	50.0	100.0
Total	n= 82	100.0	

Source: Survey data, January 2010

Like crop production, most livestock farmers' goal is domestic consumption. About 44% of the respondents keep livestock for consumption and only 12% produce for both marketing and consumption. An opportunity to support farmers in livestock production is however available in the community, where 50% of the respondents indicated their eagerness to scale up their livestock production. Further tabular presentation of the farmers' goals in livestock production is presented in Table 4.11.

Table 4. 11: Cross tabulation of membership and household goals in livestock enterprise.

MEMBERSHIP	Major livestock goals					Total
	No Livestock	Consumption only	Cultural purposes	Consumption &Marketing	Marketing only	
Non-Member	23	16	2	3	0	44
Member	13	17	1	7	0	38
Total	36	33	3	10	0	82

Though crop and livestock enterprises vary greatly in terms of labour demand and household uses, both communities had no household that entered into livestock production specifically for marketing, except to meet the consumption and cultural goal. Table 4.12 gives a summary of community participation in any one or a combination of either crop or livestock enterprises.

Table 4. 12: Household crop and livestock activity combinations.

category	**No of households**	**% of households**
No agricultural activities	2	2.4
Both crops and livestock	47	57.3
Crops only	31	37.8
Livestock only	2	2.4
TOTAL	**82**	

Source: Survey data, January 2010

The results in Table 4.12 show that 57% of the household realize the importance of combining crop and livestock enterprises at household level. Economically, this is a food security strategy and a way of spreading risk, in case one enterprise fails, such diversified farmers always have an enterprise to sustain the household. Opportunities can be explored by government to motivate the need to diversify enterprises in rural communities. However, more support is required to support

fencing of grazing areas and fields to allow the core existence of livestock and crop farming within communities.

4.2.11 Household market participation

Product value chain analysis of a specific commodity describes a connected series of organizations, resources, and knowledge streams involved in the creation and delivery of product value to producers and end customers (Kaplinsky and Morris, 2000). As such farmers' active participation on different markets is very critical in adding value of products due to varying demands of specific markets. Smallholder farmers in most developing countries are characterised by entering into short value chains and in most cases supplying raw or unprocessed products. However, lack of agricultural commodity marketing in the community suggest that communal farmers require much support to increase their level of production before marketing can take centre stage

However, it is the farmer's goal that determines the final destination of his/her produce, *ceteris paribus.* A field survey in Ciko and Mbozi communities indicated that *no* farmer entered into rain fed enterprises with the sole purpose of marketing (both crop and livestock). The fact that marketing is always attached to the consumption goal, it means that farmers in both communities market what they could not consume in the short run (Table 1.8 and Table 1.13). Therefore, it can be concluded that marketing of crop and livestock produce is ad-hoc in both communities, except where production is under irrigation.

4.3 Irrigation farming

Agricultural land in the former homelands Transkei is under-utilised, where livestock and horticulture have potential to expand (ECDC, 2006). Great efforts are going towards drawing farmers, mostly subsistence farmers, in the former Bantustans into commercial farming, as well as into moving up a notch through beneficiation of raw materials (ECDC, 2006). The South African government has launched several programmes to enhance smallholder food production in rural communities. Among these, are irrigation schemes of varying scales aiming at

minimising the impact of dry spells on famers output. For the purpose of this study, only empirical data from two irrigation schemes in Mbashe Local Municipality, namely Ciko Santrini Community Project and Foundation Community Project was used.

4.3.1 Foundation Community Project

Foundation Community Project is an irrigation scheme located in Mbozi village, which is 17km East of Willowvale town and approximately 52km from Idutywa town. Other nearby small towns includes Elliotdale and Butterworth. Foundation Community Project is in Mbashe Local Municipality, which is one of the eight local municipalities of the Amatole District. Foundation Community Project is currently benefiting from a 10 year lease of the land for its agricultural activities. The land belongs to Mbozi villagers, and through government facilitation, a lease agreement was entered into between the community and the project, which was signed by the Headmen, Councilor, Project members and lawyers. The lease is renewable after 10 years, if the project is still continuing. Sixty six hectares of land is available to the project to allow for more participants. Only 5ha is currently fenced and under cultivation. Project members are confident that they will renew their contract after the initial 10 year lease, and they do not anticipate any take over of the land by the community given that the decision to allocate land to the project was made after realizing that the land had not been in use for years, hence this was a way of putting the land under full use.

Before the project was launched in the area, the community was not using water from the Shixini River for any agricultural purposes. The river only benefited the community through livestock water and for laundry purposes. Most villagers relied on Mbozi River, and only accessed Shixini River when the former is dry. There is however no governing rules that hinder or promotes usage of water from all water sources in the community. There is no Water User Association (WUA) in the area and as such there are no water levies being paid by either the general community or the projects.

4.3.1.1 Irrigation project objectives

A focused group discussion was held to establish how the projected operated and the intrinsic strengths and challenges of collective farming. Thirteen (13) project members participated in the focus group discussion and revealed their understanding of the major purpose of the irrigation scheme, being their major reasons for joining the scheme. They highlighted that the scheme was established to:

- ensure food security among the members and the community at large
- alleviate poverty in the community
- provide employment to the local community members
- improve health and nutrition in the community
- ensure economic development through regular supplies of produce to the outside markets, and for;
- youth empowerment

Foundation Community project employ two full time workers as guards at the site and while farm labour is provided by project members. Occasionally, hired labour is used to supplement own labour during peak demand periods like weeding. Poor road condition affects the project's participation on outside markets.

The project also contribute to the poor and those affected by HIV/AIDS, by donating vegetables, butternuts and potatoes to supplement their diet. This is a positive development towards fighting malnutrition in the community.

4.3.1.2 Project infrastructure and funding of Foundation Community Project

The project was officially launched in 2007. Since 2007, the project received bulk of its funding from the Department of Social Development. A total of R250 000 was given to the project and was used to purchase and install sprinkler irrigation infrastructure (R100 000), fencing of the 5ha plot currently under use (R50 000), construction of site structures like storerooms, nursery, pit latrine (R50 000) and input procurement (R50 000). Little income is also from a once off joining fee and annual subscription fees of R100 and R20 respectively.

The project has sprinkler irrigation infrastructure that is powered by a 10HP diesel pump. Water is pumped from Shixini River. Currently the scheme operates with a maximum of twenty sprinklers being fed from delivery pipes. The corporative does not pay any water rates and is not affiliated to any Water User Association (WUA). Future upgrade of the current irrigation infrastructure is anticipated, to sustain the project's allocated 66 hectares of land. It is the responsibility of project members to invite technicians to maintain and attend to any breakdowns on the irrigation system.

Land preparation is done using a tractor, which was provided by the Amatole Municipality in 2008. Moreso, there are tractor drawn implements at the site, which includes mould board plough, disc harrow and a planter. The project site is fenced with barbed wire to protect crops against animal damage. A guard room was also built on site to accommodate the security personnel employed by the project to guard against produce and property theft.

The project is serviced by a poorly graveled road, which is not easily accessible especially under rainy conditions. This seriously affect farmers' market opportunities during the summer season, since buyers cannot access the site, and neither do the project members manage to ferry their produce up the steep slopes to the market. The end result is rotting of produce in the field and therefore losses are incurred. There is need to improve accessibility of the project, as well as identification of alternative forms of power to ferry produce to accessible pick-up points. This arrangement can however increases the farmers' transactions costs, though it is necessary to avoid complete loss of the produce by the farmers.

4.3.1.3 Foundation community project decision making process

Decision making process at Foundation Community project is done collectively, though the existing committee presides over the decisions. The project coordinator who is also a member of the group is responsible for the day to day running of the project and reports to the committee. This is a unique structure, which is slightly different from the conventional structure which normally headed by the Chairperson. The focused group discussions indicated satisfaction with this structure, but the members wish to have more educated members in the committee to improve the decision making process. The roles of the committee are to:

- make production and marketing decisions (what to grow, where to market and at what price)in consultation with project members
- attend meetings with government departments and other stakeholders
- vet all new applicants for acceptance or rejection, in consultation with project members.
- keep records for the day to day running of the project.

Project members work at the project from Monday to Saturday and an attendance register is marked by the committee. Any profit sharing among the project members is done based on the number of days worked by each project member. The project does not have any fixed rate paid to members; but, amount payable is depended on profit made.

4.3.1.4 Crop enterprises and market participation

Foundation Community Project produces a wide range of crops under sprinkler irrigation. These include cabbage, spinach, butternut, broccoli, pumpkins, potatoes, green paper, carrots and maize. Project members decide on crops to be grown at any given time after a certain crop has been harvested or concurrently depending on land availability. A combination of four crop enterprises at any given period has usually been followed.

4.3.2 Ciko Santrini Community Project

Ciko Santrini Community Project started in 2008 and has a total of 20ha. The site has 10ha fenced and the remaining 10ha is not fenced. A total of 23 members joined and formed Ciko Santrini Community Project. However, current active members comprises of 16 women and 2 men, making a total of eighteen (18). A total of 2.5ha is currently under cultivation. Ciko Santrini Community Project started as a community initiative by a few community individuals who pooled their individual rain fed fields together to do collective farming. This idea was borne out a need to secure government funding, which emphasizes on funding community projects instead of individual farmers.

4.3.2.1 Project Infrastructure and funding.

Ciko Santrini Community Project is currently being sustained by a R350 000, 00 fund from the Eastern Cape Department of Social Development. Previously, project members enjoyed exclusive rights to the project by allowing only those whose fields were fenced to take part in the project. However, due to drop outs and inconsistence in member participation, joining is open to anyone at a once off payment of R10. Attendance register is used to monitor member participation on daily basis. Sharing of proceeds is done monthly with technical advice coming from the Department of Social Development, who control the project account. Agronomic assistance is offered by the Department of Agriculture. The project is not a member of any Water User Association, and as such, the project does not pay for water usage.

The project site is fenced to protect crops from animal damage. Three storage rooms are also on site. Funding for infrastructure development, that included fencing, hoes, storage rooms, knapsack sprayers and irrigation equipment (pump, pipes, and sprinklers) came from the South national Department of Social Development. The project has a sprinkler irrigation system, powered by a diesel pump. Irrigation water is drawn from the perennial Shixini River. Currently, the project relies on hired tractors for land preparations and other farm operations.

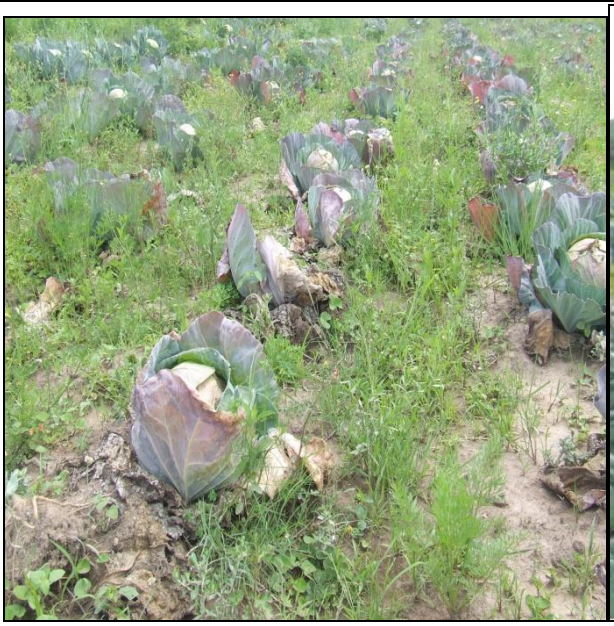
4.3.2.2 Ciko decision making process

Similarities do exist in the way Ciko and Foundation Community Projects are run. The Ciko Santrini project is run by committee which is elected by the members, but unlike the Foundation Project, they do not have a project coordinator (Figure). The committee is accountable to the project members, where all production and marketing decisions of produce are made.

4.3.2.3 Ciko Project's crop enterprises and marketing

Ciko Community Project produces a wide range of crops under sprinkler irrigation. The project produces cabbage, spinach, potatoes, onions, carrots and tomatoes. Enterprise selection is done by project members after a particular crop has been harvested and also depending on the availability of input resources. The greatest challenge at Ciko project is record keeping for all project activities. Produce are not recorded and the quantities marketed are not known as well. This poses a lot of questions as to how the project determine its profit or loss for the purposes of sharing the proceeds. In the medium term, this project will face viability problems especially after exhausting funds (R240, 000), which is currently at their disposal from the Department of Social Development.

Another challenge facing the project is the problem of water logging and inadequate crop protection strategies at the scheme. The project lost a lot of cabbage crop through rotting (Picture 1A). Urgent agronomic intervention is required, and training for farmer on proper irrigation scheduling to prevent water logging.



1A-Water logged crop and weed infested: 1B-Good crop not affected by water

Picture 1A & 1 B: Cabbage crop at Ciko Community Project.
Source: Field Survey, November 2009

Both irrigation water and rain water can be the cause of water logging (Picture 1A) at both study sites. Therefore, proper and strict water management systems need to be put in place to minimize crop and soil damage due to excess water.

4.4 Challenges faced by Ciko and Mbozi Individual household farmers.

Agricultural production and marketing among smallholder farmers is believed to be constrained by several variables, ranging from technical, social, economic, political and cultural factors. This has resulted in low production and thin markets in most developing communities. A field survey in Ciko and Mbozi villages of the Mbashe local municipality revealed that most farmers had limited access to crop and livestock inputs, that include seed, fertilisers, labour and finances. This is supposedly one of the major causes of low yields among smallholder farmers in the two villages under study. Farmers at the Ciko and Foundation projects have listed the following as the challenges the faced. They include:

- Lack of finances to fund agricultural activities, and a major lack of finances is a major drawback in acquiring farm assets.
- Destruction of farm/crops by stray animals.
- Transport infrastructure is bad, characterized by bad gravel roads which are not accessible during the wet season.
- Livestock theft is also a deterrent factor for cattle and goat production in both Ciko and Mbozi villages.
- Lack of draught power. The limited number of people who own cattle in Ciko and Mbozi communities (25.6%) can actually support the view that there is a shortage of draught power in the area Farmers in both community cited challenges in hiring a tractor for land preparation due to a requirement that a minimum of ten (10) households can hire a tractor to prepare their land. Problems of coordination has put most farmers who are in need of services to suffered because at times they fail to make a group with the minimum number of 10.
- Access to irrigation was also limited by the need to pay joining fee, which farmers claim they could not afford. The joining fee for Ciko Santrini project is currently set at R10, while that for Foundation Community Project is R100. Joining fee is paid as a sign of commitment to the project by new entrants. Whilst Foundation community Project charges a fairly high fee, youths below the age 35 years are exempted from paying. This is meant to attract more youths to join the project as a job creation strategy as well as attracting labour force to join the scheme, instead of it being dominated by the old and weak.
- Pests and diseases were cited as a major threat to crop production in Ciko village. This calls for on farm training of the farmers on pest and disease identification as well as controlling strategies.
- Cattle were badly affected by ticks due to inconsistent dipping in both communities.

4.5 Major challenges affecting Ciko and Foundation Community projects

One focus group discussion was conducted at each site, i.e. Ciko Santrini Community Project and Foundation Community Project. Both sites practice collective production and marketing of produce. Below is a list of challenges that were brought up during the discussions.

- No modernised equipment like boom sprayers, dibblers, ridger and seeders.
- No contracts with established buyers and fresh produce markets
- Cash shortages for input procurement at Foundation Community Project
- Poor transport system and poor road condition
- No electricity at the irrigation sites, hence use of diesel pumps for irrigation.
- No proper packaging for delicate produce like broccoli and cauliflower, hence limited production of these specific vegetables.
- Ciko project has no tractor and relies on hiring.
- Shortage of technical expertise to maintain irrigation infrastructure hinders efficient running of the system.
- Inadequate training of project members on such aspects as pest and disease identification, chemical mixing and application, irrigation scheduling and irrigation maintenance.
- Poor drainage and water logging has caused loss of cabbage crop at both Ciko and Foundation Community project (Picture 1A).
- Water weed (Nut-surge) is seriously affecting plot project plots and urgent attention is required to control the weed.

4.6 Opportunities in Ciko and Mbozi village to improve agricultural production

- Shixini River is perennial; hence expansion of the existing irrigation projects is not constrained by water availability.
- Free water has the potential to offer farmers more returns compared to those who pay for the resource.
- Free access to land as well offers good growth opportunities for corporative farmers through availability of land for expansion purposes.

- Farmer training to re-orient their goal towards commodity marketing can be a stepping stone in developing agriculture in both communities.
- The study identified a need to capitalize the projects through provision of implements such as ridgers, boom sprayers and tractor drawn trailers to improve production and marketing of produce.
- Road improvement and maintenance especially to Foundation Community Project will greatly improve the project's accessibility by buyers of fresh produce.
- Proximity to Willowvale and Idutywa offers a good market for the produce, hence a need to improve road transport system in the area

4.7 Chapter summary

A well established characteristic of farming is the large variation in farmer productivity observed on individual farm holdings, in terms of such factors as size of farm, labour and capital inputs. Demographic and household variables were synthesised using descriptive statistics. Agricultural production and marketing among smallholder farmers is believed to be constrained by several variables, ranging from technical, social, economic to cultural factors. This has resulted in low production and thin markets in most developing communities. A field survey in Ciko and Mbozi villages of the Mbashe local municipality revealed that most farmers had limited access to crop and livestock inputs, that include seed, fertilisers, labour and finances. This is supposedly one of the major causes of low yields among smallholder farmers in the two villages studied.

CHAPTER 5

FOOD VALUE CHAIN MAPPING FOR SMALLHOLDER FARMERS

5.1 Introduction

The survey indicated that value chain participation through commodity marketing by farmers in Mbashe Local Municipality was very minimal at household level. This study therefore explored farmer involvement in specific food value chains in Mbashe Local Municipalities for both crop and livestock enterprises. Value chain analysis takes into account different crops grown during the different seasons and analysing the chain of activities and transactions that occur during the process of producing, transforming, storing, transacting and consuming the crops and crop products. The same sequence of activities is as well followed for cattle value chain.

The main objective is to map and empirically investigate appropriate food value chains in relation to water as a production input. The study explored opportunities available for smallholder farmers through active involvement in food value chains for both crop and livestock enterprises. Specifically, the study investigates amongst others (1) The different market outlets of food crops, animals and animal products; (2) Different attributes of the markets in these value chains and (3) different opportunities and constraints of entering food value chains by subsistence and emerging farmers.

Maize, cabbage and cattle value chains were analysed through a scrutiny of the respective product flows. Each value chain activity was quantified in terms of price, intermediate consumption and value addition, through extensive survey and primary data collection in each of the four value chains in Mbashe local municipality.

5.1.1 Crop production associated with irrigation projects

Farmers at Ciko and Foundation Community projects use crop diversification as a strategy to synchronise crop seasonal requirements in terms of consumer demand and climatic conditions. As such a huge number of vegetable crops are grown concurrently or in a cycle throughout the year. Profitability and easy market access for individual crops is not thoroughly considered during the decision making process. Moreso, crop water requirements including irrigation system efficiency are not taken into account when deciding which crops to grow under the sprinkler system. Figure 5.1 shows a breakdown of revenue contribution for specific crops grown at Foundation Community project in the 2009 cropping season.

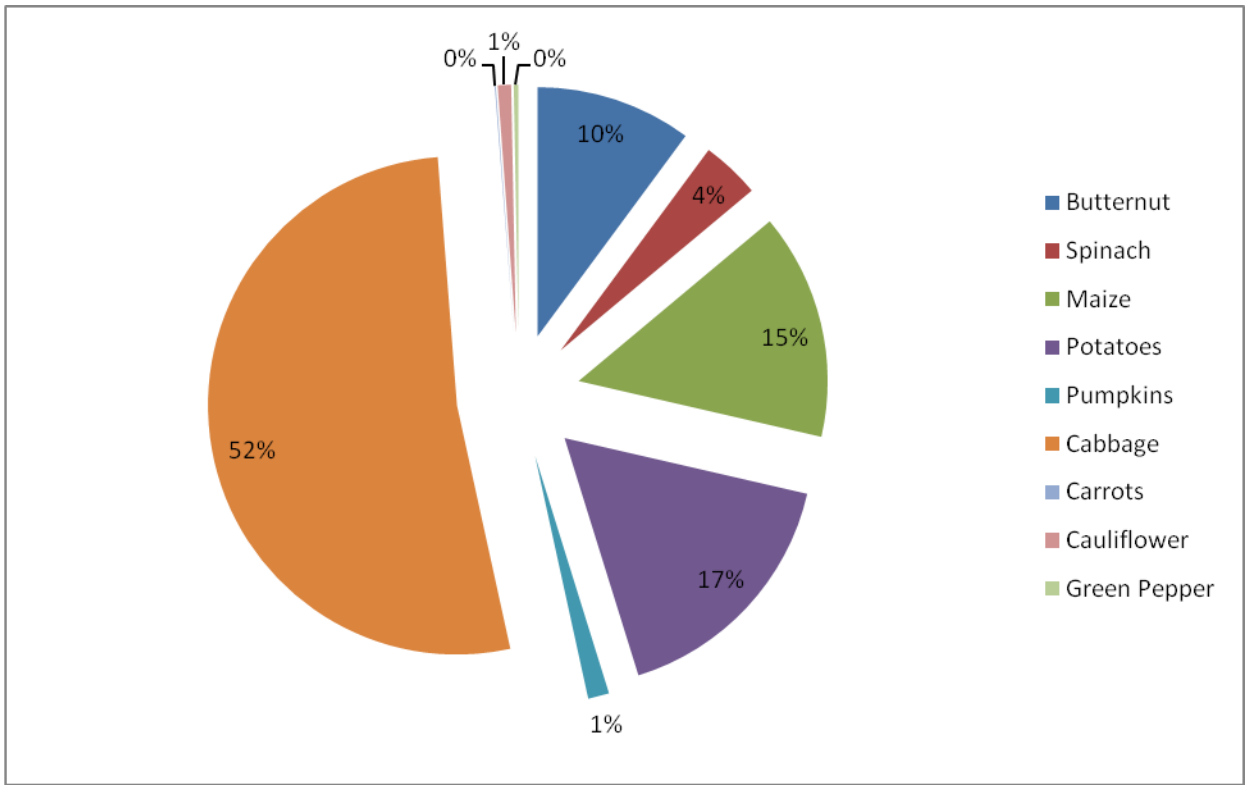


Figure 5. 1: Relative importance of crops grown at Foundation Community Project in terms of revenue.

Gross revenue figures indicate that cabbage (52%) is the main marketed crop grown at Foundation Community Project (Figure 5.1) while other crops are for own consumption. This is

similar with Ciko Project as well, but due to poor record keeping at Ciko, quantitative figures could not be presented, hence reliance on qualitative description of their activities. Potatoes and maize contribute significantly to the project's income with 17% and 15% of the project's income coming from potatoes and maize respectively. Green pepper, carrots and cauliflower are not major contributors to the project's income.

There are two value chains that the study has explored at Ciko and Foundation irrigation projects, namely cabbage and maize production. Some of the aspects are considered together in the sections below to avoid duplication.

5.1.2 Water use in farm production

Water use efficiency is the critical factor for successful agriculture in South Africa, where water scarcity is increasingly becoming a topical issue both at policy level and consumption/utilisation level. It is apparent that South Africa, as a developing nation ensures that sustainable water usage and allocation policies are adhered to, for sustained agricultural and economic growth.

To remain competitive, producers need to continuously increase or maintain production, or alternatively reduce production costs. An increase in production is feasible at both Ciko Santrini Community project and Foundation Community project where part of the land is not being utilised and irrigation water is not a constraint. When data was collected in January 2010, Ciko Community project had 2 hectares of the 20 fenced ha under crop production, which represented 10% utilisation. During the same period, Foundation Community project had 5 hectatres of the 7 fenced hectares under crops, which shows a 71% utilisation. It is also important to note that Foundation Community project has a total of 66 hectares at their disposal for expansion purposes, which allows the project to accommodate more project participants.

Water is drawn from the perennial Shixini River for the two schemes. Pumping becomes a challenge only if the project runs out of fuel or when the pumps break down.A qualitative investigation into the changes in water use patterns and production systems was done through focused group discussions with members from the two projects, where 11 members participated at Ciko irrigation scheme and 13 members participated at the Foundation Community project.

Table 5.1 summarises the major findings in terms of water usage by the two communities, before the launch and after the launch of the irrigation schemes.

Table 5. 1: Water usage before and after the launch of Ciko and Foundation Community Projects

Ciko Community (Where Ciko Community Project is located)	
Water usage before project	**Water Usage after project**
• Community members used buckets to water their gardens, and water was taken from Shixini River. • No restriction/control over water access. Anyone can use water from the river, as long as it is available. • They only concentrated on maize and not other crops. • They used very little, because there was a lot of effort required in using the bucket system. • Project is not a member of a Water User Association (WUA)	• Now the members use a diesel pump to irrigate their crops. • There is still no restriction/control over water use for any member of the community. • Farmers have since diversified their crops by including butternuts, cabbages, cauliflower and spinach instead of concentrating on maize only. • Farmers believe that the launch of an irrigation project has improved their income. Farmers are now able to sell their produce, which they did not do before. • Project is not a member of a Water User Association (WUA) • Daily water used is not measured; hence total volume used to date or per given period is not known.
Mbozi Community (where foundation Community Project is located)	
• The community was not using Shixini River for any cropping activities, instead they used Mbozi River. • No controlled access to water. • Shixini River mainly catered for livestock and washing. • They used the bucket system along the Mbozi River to water crops. • Project is not a member of a Water User Association (WUA)	• Started using Shixini River for irrigation purposes because it is perennial. • No control access to water • More diversified crops, especially vegetables like broccoli, cauliflower, potatoes green pepper all started after the scheme was launched. • Project is not a member of a Water User Association (WUA) • Daily water used is not measured; hence total volume used to date or per given period is not known.

The summary in Table 5.1 shows areas where existing water policies and legislation are not being implemented. Such policies include the requirement for all commercial water users to be

members of a Water User Association and the need to account for all water usage for commercial and domestic purposes through appropriate measurement techniques and procedures.

Table 5. 2: Water pumping at Ciko and Foundation Community Project (Sprinkler System)

Cost Item	**Foundation Community Project (5ha)- Sprinkler Irrigation System**		**Ciko Community Project (2ha)-Sprinkler Irrigation System**	
	Rates	**Value (R) / Month**	**Rates**	**Value(R)/Month**
Pumping Fuel Costs	40 litres/Week @R8/litre	R1280 [R256/ha]	20 litres/2weeks @R8/litre	R240 [R120/ha]
Maintenance labour	• Project members work the fields and operate the irrigation system. • Repairs are done by the project coordinator; however experts can be hired in case of a major breakdown. So far, no major breakdown has occurred.		• Project members work the fields and operate the irrigation system • Repairs are done by hired unskilled man in the village at R40/day. (Approx. 3 days/month = R120)	
Water Levies	Do not pay		Do not pay	
Sprinklers and pipes	Have not been replaced since installation in 2006.		Have not been replaced since installation in 2007	

Foundation and Ciko Community projects use sprinkler irrigation system (Table 5.2). Both pumps for the two irrigation projects are diesel powered. The pump at Foundation Project was only serviced once and its oil changed in 2007, and to date no major breakdown or general service has been done on the pump. The pump at Ciko Project as well had never been serviced since 2007 when the pump was installed. Ciko Project relies on untrained villagers to do repairs in case the pump breaks down. The maintenance regimes of the two pumps seem not to be adhered to, and future problems are anticipated in the form of major breakdowns, more frequent breakdowns or reduced pumping capacity, which might be difficult for farmers to restore.

However, during the site selection process across some irrigation projects in Eastern Cape it can be inferred that water prices are low to encourage savings or efficient utilisation of the commodity. For instances, a discussion with the HACOP Irrigation Project (Amatole Municipality, Eastern Cape), who belong to a Water User Association, that oversees the abstraction of water from the Kat River, indicated that the project paid R35/per annum for using water for irrigation. The levy is fixed and does not take into account individual or cooperative usage of water. The levy comes from the sales revenue at the project and not from individual contributions. The principle behind such low rates could be to promote utilisation of the commodity by the poor for productive purposes.

As enshrined in the White Paper on a National Water Policy for South Africa (DWAF, 1997), the price of water varies according to location and is calculated on a system, catchment or sub-catchment basis. The price includes operating, maintenance and capital costs where appropriate as well as a water resource management levy and a resource conservation charge. The levy may include charges for effluent disposal and significant interception as a result of land uses such as forestry or agriculture. DWAF (1997) stipulates that previously disadvantaged individuals and communities should be supported through specific measures for beneficiaries of land restitution, land reform or other programmes of corrective action. These may include periods during which the full cost of water will not be charged. This would be a form of establishment support in the case of newly established enterprises. Where the imposition of the full water price discourages the use of available water, provision may be made for some elements of the tariff, including capital and depreciation costs in existing Government water schemes, or the resource conservation charge, to be suspended for a limited period of time (DWAF, 1997).

However, inefficient water pricing has always been a challenge when it comes to conserving the resource and preventing the undesired effects of overuse like water logging and salinity. Visible signs of water logging and salinity are already surfacing at both Ciko and Foundation Community Projects. These include salt patches and high infestation of fields by water weeds. Presently, the price of water has less emphasis on scarcity value of water, hence smallholder farmers who have access to perennial flow of water have no push factors like cost to force them to serve water. Again this has resulted in farmers not investing in water conserving technologies.

In the face of increasing water scarcity, it would only be to the advantage of the nation if the price of water is reviewed as the current price deters any efforts for conservation.

There is a major challenge of determining crop water use efficiency in crop production at both Ciko and Foundation Community project. This is due to absence of water meters and proper record keeping. As such, volume of water being used per given crop could not be determined. Irrigation is rather ad-hoc and not based on specific crop factors, stage of growth or soil conditions. Moreso, the irrigation schemes normally grow four crops at a given time and irrigation is done concurrently hence water used per crop cannot easily be determined. Generally, infield water management at scheme level is weak. All farmers did not exercise objective irrigation scheduling methods. The two schemes used a combination of plant observation, soil observation and the "feel" method to determine the need to apply water to crops. According to the project members, irrigation schedules of 3hours stand time every 3 to 4 days were a common practice. Irrigation schedules are generally constant regardless of crop type and growth stage. There is therefore a possibility of over-irrigation during early stages of crop growth where the plant requires less water and under-irrigation at full growth stages where water requirements for most crops are high.

5.2 Cabbage Value chain

5.2.1 Cabbage farm production

Cabbages production is done at both Ciko and Foundation Community projects and marketing of the commodity is a challenge due to its bulkiness. Both projects do not have reliable transport for their produce to the market. This is worsened by the fact that most of their target market that includes retailers and hawkers insists that farmers must deliver their produce to the market.

Table 5. 3: Potential versus target returns per hectare for cabbages at Foundation Community project

Variable	Crop Spacing	Yield/ha	Price/head	Revenue Estimates/ha
Potential yield/Recommended	0.9m x 0.45m	24000 heads	R5	R120,000
Project Target Yield/Actual	1m x 1m	10000 heads	R5	R50,000
Gross Yield loss / Gain		-14000 head		-R70,000

Crop spacing is found to be directly affecting the productivity at Foundation Community Project (Table 5.3). The cabbage is grown at a wide spacing of 1m inter-row and 1m in-row spacing. This spacing can only yield a maximum of 10000 plants per hectare which is 42% of the potential plant population. Plant population is very low. An interview with project members indicated that their reason for such a wide spacing is to achieve maximum head size for the cabbages. This is however done at the expense of plant population, and this consequently affects crop margins. Arguably, water applied to one hectare of the crop will not vary regardless of different plant populations at the project, where water applied to crops is not measured.

The project did not give enough evidence of real price difference between small and big cabbages at the market. Prices tend to follow seasonal variations that affect demand and supply of the produce. Farmers can benefit by increasing plant population and producing medium sized cabbages and sell at a price slightly less than R5, and still get more revenue than planting too few plants and sell at R5, assuming is responsive to cabbage size. The minimum price of small cabbages at the ideal spacing (24000 plants) is R2,00. However the project's minimum price was R3,50/head, and if this price was applied to 24000 plants/ha a potential revenue of R84,000/ha would have been realised. Therefore the opportunity cost of wide spacing is R36,000/ha at minimum price of R3,50/head. Such lack of full utilisation of land and water has a great impact on the long term sustainability of irrigation projects. It can be argued that bulk of the water applied to widely spaced crops is lost through evaporation and runoff since the few plants cannot utilise all the water applied, except in the case of drip irrigation systems where water is directly applied to individual plants. However, proper agronomic trials need to be performed so as to come up with solid technical advice on the relationships between cabbage head size, plant

population, water use efficiency, nutrient use efficiency and net gains to the farmer. More so, such field trials to determine inefficiencies based on crop spacing, soil type and water application rates.

The cabbage value chain in Mbozi and Ciko communities is very short, with a limited number of players (Figure 5.2). Cabbages produced at Foundation Community Project are sold through different market channels that include hawkers, community, supermarkets and through fruit and vegetable shops. The cabbages then undergoes some transformation depending on the channel that it went through, but supermarkets have shown that they do further processing of cabbages for the market. Figure 5.2 shows the flow of cabbages from farm level to consumption.

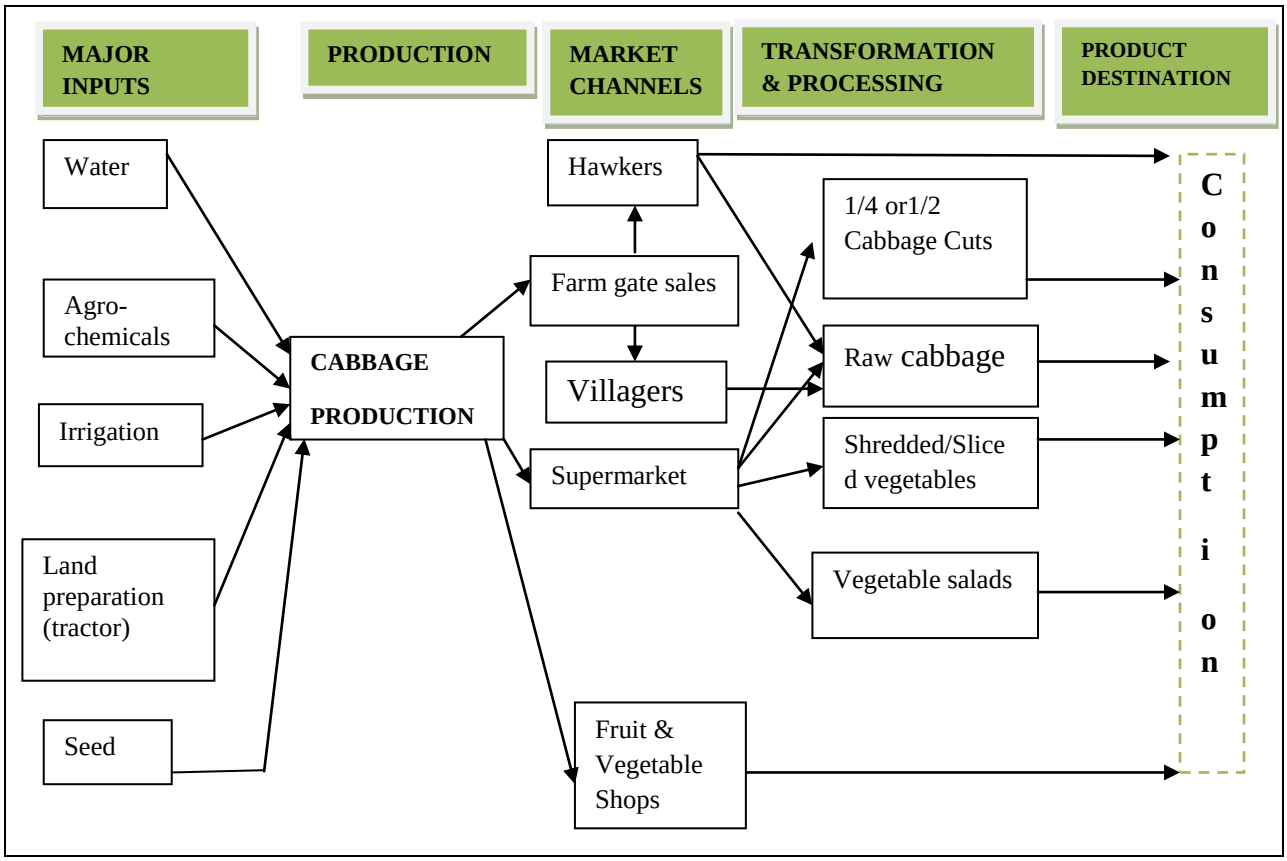


Figure 5. 2: Product flow of cabbages produced at Foundation and Ciko Projects.

5.2.2 Cabbage Input supply

On the production front, there are input suppliers of seeds, fertilisers and herbicides, which are used to produce crop yields at the project. The other major inputs include water, irrigation pumping costs, labour and land preparation of the fields.

Table 5. 4: Distance of procurement towns from Foundation Community Project site.

Town/Location	Distance from Foundation Community Project
Willowvale	17km
Dutywa	52km
Butterworth	82km
East London	226km

East London is located far from the project site, but it is the major source of the agro-chemicals being used at the projects. This is mainly due to the availablity of wider options in East London, in terms of suppliers making price comparisons easier. Umtiza Farmers Coorp, at Dutywa, is also strategically located to cater for the inputs needs of farmers in the Mbashe local municipality.Cabbage seed price range between R250 and R420 for a pack of 10,000 seeds. Seed packs are common at household level, while seedlings were mainly used in irrigation projects. The major supplier of cabbage seedlings is Rainbow seedlings in East London. Crop diversification at Foundation and Ciko Community project has always been used to manage seasonality of some crops. However, such a mix requires a good understanding of more profitable enterprise combinations. The cost of production must be considered together with the farmers' technical know-how of the selected crops.

5.2.3 Cabbage Transportation and market accessibility

Ciko Project members use wheelbarrows to transport their cabbages or any other produce from the field to the road side (1600m), from which hired transport collect the produce to the market in Willowvale town (7km from the site). It cost the project a minimum of R150 per trip to hire a

one tonne truck to transport their produce to the market. Due to lack of guaranteed market at Willowvale, farmers are restricted not to harvest bulk produce at once. About 40-50 cabbages are harvested for the market at a time. The project sells their cabbages at R5 per head. If they manage to get a market for the whole load, the farmers will only have a gain of R50 per trip. This is not viable given that cost of labour and inputs still need to be deducted from such a small margin.

Foundation Community project also experience the same challenge of the unavailability of ready market for bulk supplies to cut on transport. Moreso, Foundation project is affected by poor road that links the project to the community and Willowvale town. The road is too steep, bumpy and un-graveled. Under such conditions, the produce at the project at times decompose in the field. However, another observed practice, was the use of the project tractor to put bags of cabbages and green maize cobs at the back of the tractor, tied on the hydraulic suspended plough, and carry the produce to the market.

5.2.4 Cabbage value addition and processing

Processing and value adding is generally seen as a means to increase profits and sometimes to better access markets. Figure 5.3, shows the importance of value addition in agricultural marketing. As the cabbage undergoes value addition and repackaging at retail level, the marketing margins increases greatly from the farm gate price.

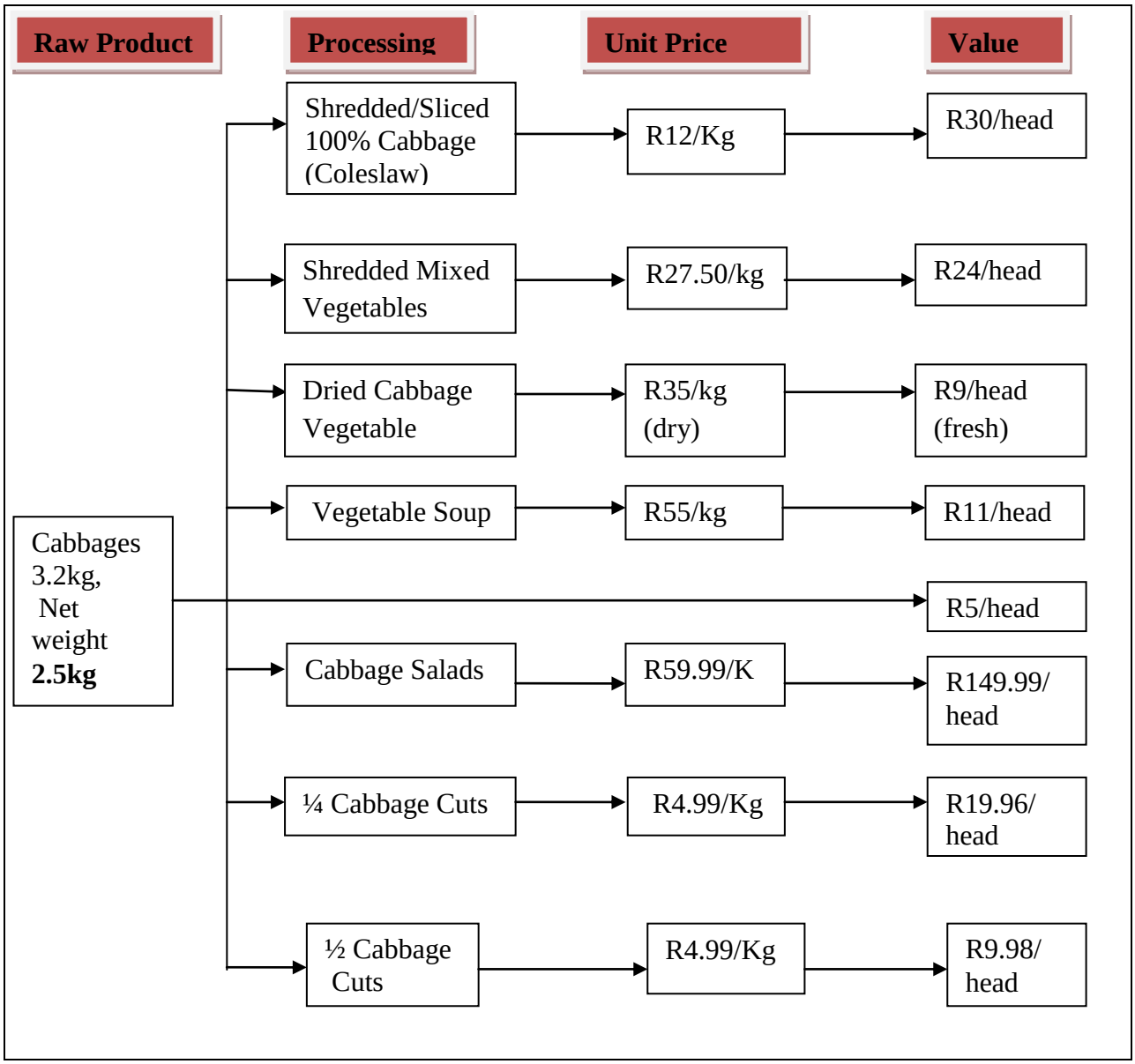


Figure 5. 3: Cabbage value chain through the supermarket channel.

Product description for the processed cabbage presented in figure 5.3 can be summarised as follows:

- Shredded Mixed Vegetables: Cabbage (87%) +Carrots (10%) +Onions (2%) +Green paper (1%)
- Shredded/Sliced: 100% Cabbage (Coleslaw)
- Cabbage Salads: Shredded Cabbage + salad cream

- Dried Cabbage Vegetable: 12kg fresh gives 1kg dried cabbage (Done by AGRIPARK-Agro-processor)
- ¼ Cabbage Cuts: One cabbage is cut into 4 equal pieces and wrapped in plastic for sale
- ½ Cabbage Cuts: : One cabbage is cut into 2 equal pieces and wrapped in plastic for sale

The average selling price at farm gate during the data collection period was R5/head of cabbage, with the lowest price being R3.50. A follow up on the cabbage value to Mega-Save Supermarket at Willowvale, Spar Super at Dutywa and many other supermarkets that operate restaurants, indicated that some form of processing is done on cabbages to increase its final value. Figure 5.3 summarises the average price variation of cabbages sold in different forms by different retail outlets in Mbashe local municipality (Willowvale, Dutywa and Butterworth towns).

The marketing margin increases as the cabbages undergoes value addition. The widest margin occurs when the cabbage crop is traded as a vegetable salad. Although labour, refrigeration and additives are added to the cabbage value, an average price value of R59.99/kg compared to R1.35/kg (R5 per 3.2kg head) remains a greater margin to be ignored. By extrapolation, one cabbage traded as a vegetable salad will potentially give R149.99 per head after removing 0.7Kg wastages and the unwanted material (Figure 5.3). The calculations were based on actual average cabbage weights in retail outlets. Such price differentials requires that farmers be introduced to first level processing of their products into packed cabbage cuts and sliced vegetables to improve retains.

5.2.5 Cabbage markets and prices

Denison and Manona (2007) noted that one of the central challenges facing high-value horticultural crop production is the existence of a sophisticated logistical chain between the producer and the end consumer. The complexities of the value chain greatly affect smallholder emerging farmers who are in most cases resource constrained. Cartwright (2002) as cited by Denison and Manona (2007) emphasised the need for horticulturalists on small tracts of land to gain sophisticated crop production processes as well as contracting the agribusinesses that control the marketing of high-value food value chains. The same sentiments were echoed by

Backeberg (2006) as cited by Denison and Manona (2007) argues that one of the few options available given the historical exclusion of emergent farmers from profitable networks is to engage in contracts with the agri-business sector and enter the higher value markets. Whilst these findings remain valid and beneficial to the smallholder irrigation farmers, it remains a challenge to build a strong and reliable relationship between smallholder farmers and the agribusiness traders and processors. The major challenge is lack of trust between producers and processors and inconsistent production patterns by the emerging farmers.

Current marketing strategies and markets are discussed in the following sections for cabbages and maize. Figure 5.4 shows the market channels being accessed by Ciko and Foundation Community projects for both maize and cabbages.

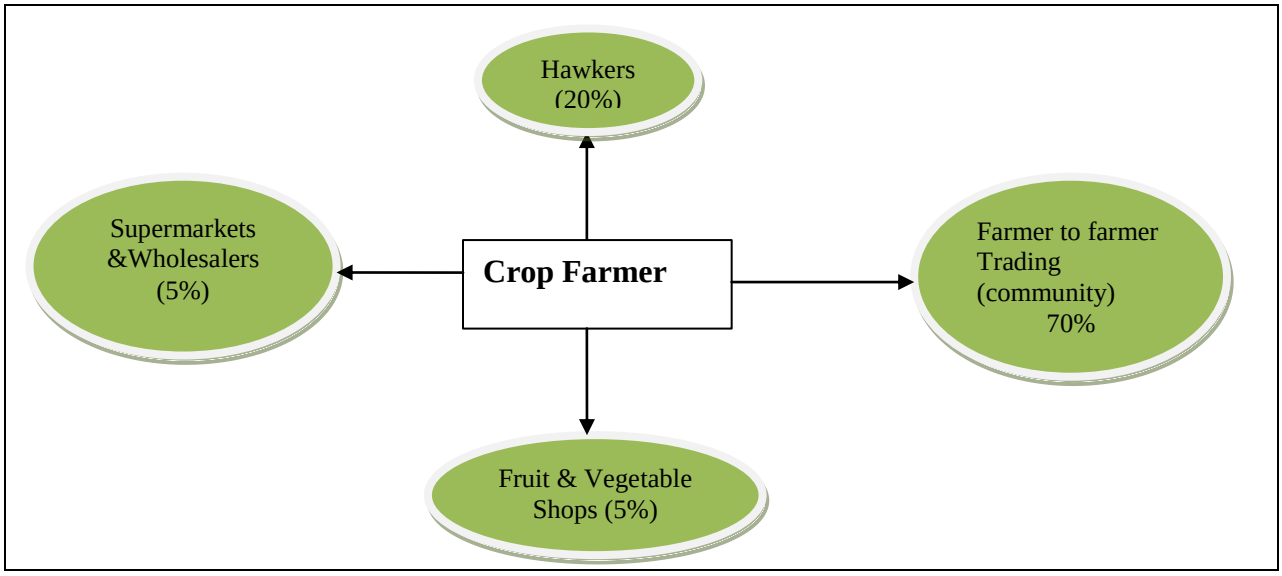


Figure 5. 4: Marketing channels for crops and vegetables for Ciko and Foundation Projects.

Erratic supplies and lack of transport is affecting farmers' participation on competitive markets like the fresh produce markets. All their produce is destined for the informal markets that include hawkers, neighbours, fruit and vegetables shops and retail stores (Figure 5.4). The hawkers and villagers collect the produce at the farm gate, while supermarkets and fruit and vegetable shops wait for farmers to supply their produce. Public transport is therefore hired by individual projects to transport available produce to the buyers (supermarkets and Fruit & vegetable shops).

The cabbage value shows an increase in value as processing continues along the chain (Figure 5.3). Farmers at Ciko and Foundation Projects trade fresh and unprocessed cabbages at farm gate. The value addition of the traded cabbages depends on which market the cabbage is sold. The cabbage that is to neighbours and hawkers are consumed without further value addition. However, supermarkets are involved in value addition and product differentiation of cabbages. Cabbages are cut into halves, quarters or shredded to make vegetable salad. Each process increase revenue of cabbage. However, agro-processors like AGRIPARK process cabbages into soup, dried vegetables and mixed vegetable packets that fetch high market values. Such agro-processors are currently not being accessed by Ciko and Foundation Farmers. AGRIPARK, which is currently based at University of Fort Hare, has opened a processing plant at Dutywa Town to cater for all smallholder producers in the surrounding communities. This can be useful to Ciko and Mbozi farmers as well, who have always failed to take their produce to East London Fresh produce or Kei Fresh Produce market in Mthatha.

5.3 Maize value chain

5.3.1 Maize farm production

The maize value chain at Foundation and Ciko Community do not go beyond the Mbashe local municipality and is characterised by very minimal value addition. Under rain fed agriculture, there is no marketing of maize either as green cobs or dry grains. This can be due to seasonality of rain fed farming, which allows everyone to produce the crop in their fields or homestead gardens thereby dampening the market for the produce.

Irrigated maize can be produced in winter and during dry periods, hence returns are usually high. At Foundation Community Project maize is traded as green either as cooked or uncooked. At Foundation ommunity Project, uncooked green cobs contributed 72% of maize revenue, while cooked maize contributed about 28%. There is no trading of maize grain at both Ciko and Foundation Community projects, which is either freely shared among project members or donated to needy families and HIV/AIDS patients in the community.

Averbeke (2004) in a study conducted at Dzindi, realised that 85% of the maize produced during the 2001/02 season was grown for grain and the rest was harvested as green cobs, but in monetary terms, green cobs contributed more than 40% of the gross value of maize production. This is not the case at Foundation Community Project, where maize grain production is not the core purpose of producing maize. Figure 5.5 shows maize product flow at Foundation Community Project.

Processing and transformation of maize is not very dominant in Mbashe local municipality. However, although maize grain produced at the study site does not go beyond the boundaries of Mbashe local municipality for further processing and more prolonged value chains, secondary sources indicate Mbashe Municipality as a green belt where considerable grain production takes place under the government supported Massive Food Production Programme (MFP). A thorough scrutiny of the production patterns and the marketing system within the MFP is required to assist emerging irrigation and rain fed farmers to benefit from the system. Figure 5.5 below shows a comprehensive flow of maize at Ciko and Foundation Community projects.

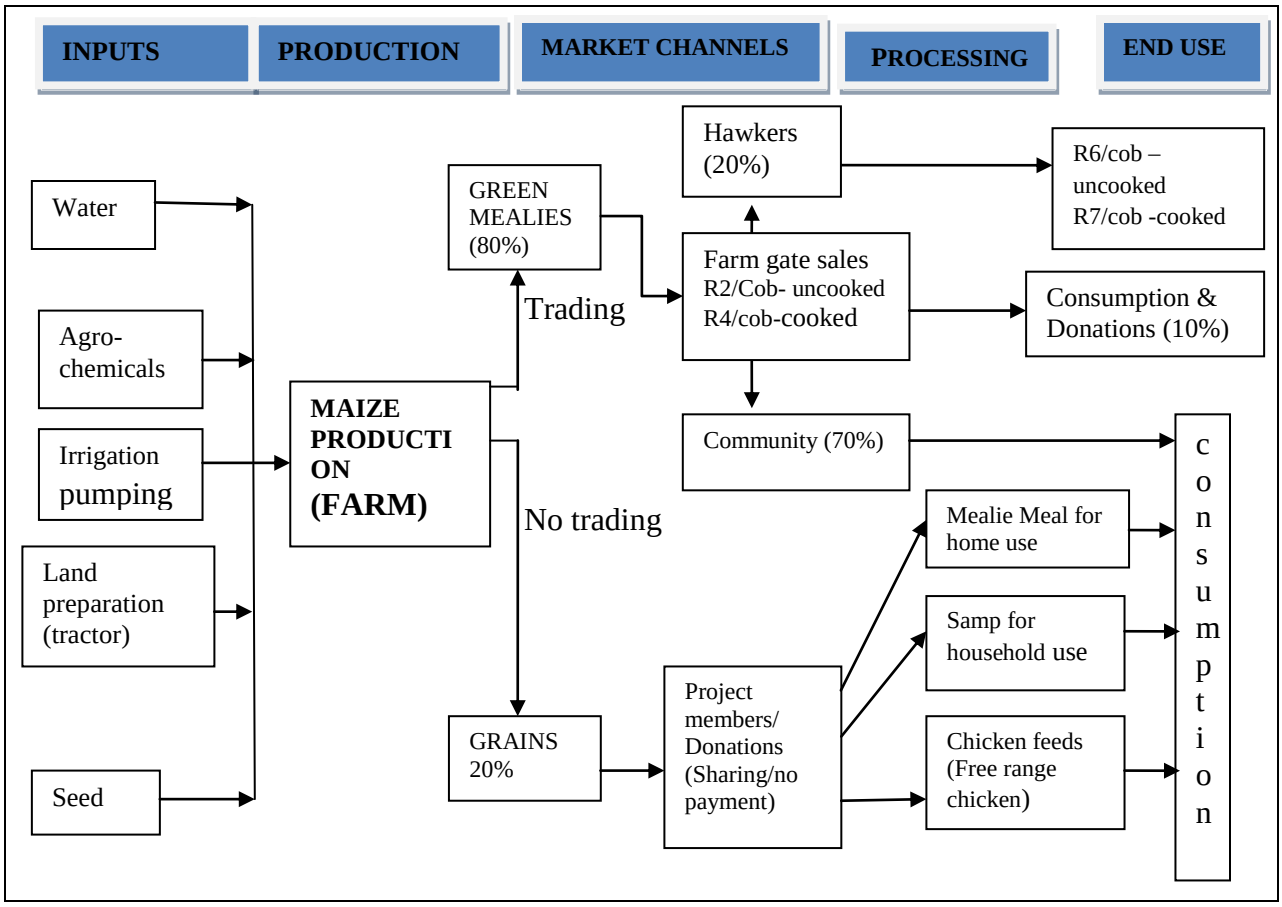


Figure 5. 5: Product flow of maize produced at Foundation and Ciko Projects.

The lack of commercial trading of maize grain greatly excludes farmers from the cereal value chain at Foundation Community Project (Figure 5.5). Community members produce their own grain under rain fed conditions while project members' benefit from both rain fed farming and sharing unsold maize from the project. Focused group discussions with project members revealed that most recipients of grain use it to feed their free range chicken (unprocessed), process it into samp or use it for mealie-meal (for human consumption and pats).

5.3.2 Maize input supply system

Maize production is done at both Ciko and Foundation Community Projects. Some villagers resort to seed recycling from previous seasons as a way of cutting on seed procurement cost. This practice is common for maize, pumpkins and tomatoes. However, although seed recycling is done at household level, this is not practiced at both Ciko and Foundation project.

Hybrid maize seeds (SC 701) is used to grow maize under irrigation at the two schemes. Seed, fertilisers and herbicides being used at Foundation Community Project are procured from East London (Table 5.4). The major suppliers are Stark Aryes, Dumisk, Farmer Rama (S Maria's Guest Trading C.C), Terrafin and Umtiza Farmers Co-op.

Hybrid maize seed price from the suppliers averaged R1800, with a minimum of R1600 and a maximum of R2, 010 for a 25kg bag. The most dominant maize variety is SC 701 and 10kg bag of seed is normally planted at a time at Foundation Community Project.If a standard seed rate 31kg/ha is used, then only 0.3ha is put under maize at a time.

Key informant interviews with project leaders revealed low hectarage for maize is due to unviable markets. Reasons for such low quantities at a time included challenges in selling large volumes of green cobs within a short period of time. Since these farmers trade green maize, they have a limited time between maturity and drying off, to sell the commodity. Given the challenges in transporting the commodity to the market, farmers resort to cultivating fewer hectares at a given time. Failure to market maize within the required interval would mean a financial loss since farmers do not trade grain. Project member share the grain for domestic consumption and free range chicken feeds.

Though farmers apply both basal and top dressing fertilisers, records on applied quantities and specific intervals of application could not be established. The major challenge was to split fertilisers used for different crops but drawn from the same bag. For instance a 50kg bag of LAN 28% was used to fertilise cabbages, maize and spinach on different dates and applied by different project members. Under such circumstances, accurate record keeping is required to account for inputs for specific enterprises. This is a major challenge on both Ciko and Foundation Community Project.

5.3.2 Maize Grain Storage

Due to low output levels, farmers in Mbozi and Ciko communities often have very limited amount of grain for storage. Farmers keep grain for not more than four months. No chemicals are used to protect the grain against pest damage. Sacks are used to store grain in the house, and milling (converting grain through grinding to make mealie meal or other products) is done in small quantities as household needs arise.

5.3.3 Maize Grain Transportation

Grain transportation for milling (converting grain through grinding to make mealie meal or other products) involved the use of public transport that commute between the village and Willowvale town. Smaller quantities below 25kg are not charged on public transport; hence farmers usually avoid a once off processing of grain to save on transport cost. Beyond 25kg, luggage charges on public transport range between R10 and R30, over a 17km distance (Mbozi village to Willowvale Town). Household members combine their shopping trips with taking maize grain to the mill.

5.3.4 Maize value addition processing

Both Mbozi and Ciko communities process their maize grain at Willowvale Supermarket, trading as Mega Save. Mbozi and Ciko communities indicated that course ground maize (samp) and maize meal are their major source of starch. A 47.6% respondent rate for villagers who consumed course ground maize (samp) at their homestead a day prior to the interview is significant to infer that part of the grain is processed for this purpose (Table 5.5). Own processing of grain into samp is cheaper for households than buying the product from retail shops. There is therefore a need to motivate farmers to produce their own grain as a way of cutting down their household expenditure on starch. Processing of grain into samp greatly benefits farmers who take the bran (by-products) home to supplement the diet of their free range chicken.

An interview with the owner of at Mega Save supermarket (Family business) revealed that most community members bring grain for processing at the grinding mill. Grain is either coarse-ground to make samp or fine-ground to make mealie-meal. The shop also sells yellow and white grain in 5kg, 10kg, 15kg and 40kg bags. A 40kg bag of white grain cost R80 at Mega Save Supermarket and is processed at a cost of R10/bag. Community members find a total cost of R90/40kg cheaper than buying refined brands. For instance, 40kg of White Star mealie-meal cost R224 (R28/5kg), which might be out of reach for most people.

The marketing of most agricultural products in South Africa was extensively regulated by statute, based on the original Marketing Act (1968). Most products were regulated under the 22 marketing schemes introduced from 1931, including the Marketing Act of 1937 which was consolidated in the Marketing Act of 1968. The Marketing of Agricultural Products Act (1996) gave birth to the National Agricultural Marketing Council (NAMC), whose immediate task was to dismantle the existing marketing control boards, and subsequently to manage and monitor state intervention in the sector (Vink and Van Rooyen, 2009). According to Vink and Van Rooyen, (2009), the effects of deregulation differed between the field crop, the horticultural and the livestock subsectors of agriculture, partly because of their different modes of production, and partly because the nature of control under the old 1968 Act and its predecessor differed between different commodities. Major field crops were sold under a 'single channel fixed price' marketing regime, characterised by pan-territorial and pan-seasonal pricing (Vink and Van Rooyen, 2009), where pan-territorial prices resulted in farmers closer to the market effectively cross-subsidising those further away who faced higher transport costs.

Market deregulation caused regional price differentiation to reflect transport costs and regional variations in demand and supply (Vink and Van Rooyen, 2009). With deregulation, the major grain industries (maize, wheat) became more differentiated across space and over time. An increasing proportion of the maize crop is now milled by small-scale millers, both on- and off-farm (industry estimates suggest this can be as high as 30% of the crop) (Vink and Van Rooyen, 2009). This has impacted the rural areas in three ways: first, there are increased opportunities for small and medium scale businesses in processing and distributing maize and maize products (Vink, and Van Rooyen, 2009).

5.3.5 Maize marketing

Maize trading at Ciko and Foundation Projects is mainly for green cobs. In fact, production is done targeting the green maize market, which is dominated by hawkers and villagers. In January 2010, Foundation Community traded uncooked green cobs at R2/cob and cooked cobs at R4/cob. Farmers prefer green maize production to grain production. They cited high revenue potential as the major reason for trading green maize instead of grain. The challenge is however on achieving big cob sizes with good cob length to be able to sell the all the green maize at competitive prices. Consumers and hawkers do not buy small cobs hence they are left to dry in the field. On the other hand, supermarkets are not actively involved in green maize trading. Maize grain is not traded at both Ciko and Foundation schemes. At Foundation Community Project, the project members share the dry cobs for home consumption while some is donated to HIV/AIDS patients in the village.

5.4 Markets for crops and vegetables

5.4.1 Role of hawkers

Hawkers fall into different categories that include owners, employees of big traders who extend their businesses into the streets and relatives of business owners (Table 5.5).

Table 5. 5: Ownership of hawking stands at Willowvale and Dutywa towns

Ownership of Hawking Business	Frequency	Percent
Seller Owns the business	17	69.2
Owned by a Local Businessman	7	26.9
Relative	1	3.8
Total	25	100.0

Hawkers are very participative in crop value chains by buying from farmers or fresh produce and reselling to final consumers at a profit. Hawkers operating within Mbashe local municipality continually raised the issue of inconsistent supply of vegetables by smallholder farmers. This is

further worsened by the inability of farmers to provide proper packaging for their produce. A hawker based at Willowvale had this to say:

> "The best these farmers can do is to pack their produce in cheap plastics which are at times not good for some commodities like potatoes. Plastic packaging is very hot and hence potatoes go bad quickly."

Hawkers procure their fresh crop products directly from farmers and from fruit and vegetable shops. They have relations with fruit and vegetable owners who have transport to supply them at slightly lower prices than their usual selling price. For instance, they can get cabbages from fruit and vegetable shops which ct as wholesalers at R7.50/head and sell it at R10/head.

For perishable vegetable products, freshness of the produce is very critical to prevent losses as vegetable products especially spinach go bad within a short period of time. Hawkers prefer trading products with a fairly longer shelve life like cabbages, butternuts and fruits like oranges and apples.

Product pricing by hawkers depends on their buying price, though at times they are forced to dispose at lower than cost price when products lose quality. Hawkers have no cold rooms hence they stock less produce at a given time. The lack of refrigerators and absence of formal operating space makes it difficult to participate in meat trading, except when they slaughter their own livestock for the family and decide to sell some of the meat to raise cash.

5.4.2 Role of fruit and vegetable shops

Fruit and vegetable shop owners or their representatives were interviewed in towns that service Mbozi and Ciko villages, which include Willowvale, Dutywa and Butterworth. The role of fruit and vegetable (Fruit &Veg) shops is mainly distribution of agriculture commodities. However, procurement by most fruit and vegetable shops is directly from the fresh produce market. Though some shops know about the existence irrigation schemes near Willowvale, they indicated that they only buy from them only if they can transport the commodities to the shop. Delivery is a real challenge with both Ciko and Foundation Community projects, who do not

own any trailer or truck to transport their produce to the market. Limited financial returns and poor roads also prevent the projects from hiring transport to deliver their produce to the market.

A further probing into the participation of fruit and vegetable shops in agricultural markets revealed a very important scenario where some shops collectively hire trucks to collect fresh produce from the East London Municipality Market, but same shops are not prepared to hire transport to collect fresh produce from nearby (Foundation Project -17km, Ciko Project-7km) irrigation schemes. This is an indication of special requirements that these shops expect in order to reliably procure from a specific agricultural supplier. An interview with Mr Marios, who owns Ndubs fruits and vegetable shop at Willowvale, highlighted some aspects that need to be considered in building a strong base for smallholder agricultural projects.

Textbox 5: Interview with a Fruit and Vegetable Shop owner

Mr Marios owns two shops at Butterworth and Willowvale town, both shops market agricultural commodities (fresh produce). He does his procurement from East London Municipal Market. He does not own a truck. He combines his orders with three other shop owners who own a seven (7) tonne truck and a trailer. They collect fresh produce twice a week from the East London Market and pays R300 per trip (i.e R600/week) for transport. Mr Marios believes that the transport cost is very cheap considering the distance and the volume of produce they get per trip. They prefer the East London Market because their order is arranged by agencies before their collection date to avoid paying for empty trips. This is not possible with farmers who at times cannot fill a one tonne bakkie with produce at a time and often demand a higher price than the fresh produce market for their products, because they are selling to a shop owner and thinks he/she has a lot of money. Procuring from farmers is stressful and involves extra costs because one would need to employ more workers to do packaging of the products, buy own packaging material and high vehicle maintenance costs due to poor roads. He would rather travel 200km by tar and collect bulk products than travel 10km to get two bags of cabbages and lose his truck through breakdowns. He believes that he has a good competitive advantage over other dealers due to lower transport costs; hence supply the majority of the hawkers.

Source: Personal Interview, 19 April 2010

The interview in textbox 5 gives insights on the importance of accessibility and how road network system affects smallholder farmers. Fruit and vegetable shops can offer a good market for smallholder farmers especially in rural communities, where direct competition from large

commercial farmers is assumed to be low unlike at fresh produce markets. However farmers fail to utilise this opportunity due to resource constraints as well as production and market related factors.

Production levels and product quality are some of the critical factors affecting relationship between smallholder irrigation famers and the major buyers like fruit and vegetable shops. Foundation Community Project in 2008 managed to supply their cabbages to Georges Fruit and Vegetable Shops at Dutywa and Butterworth. The trading relationship is getting weak and is no longer as it used to be when the project started. A discussion with the management of Georges fruit and vegetable shop focused on the challenges the business experience in dealing with smallholder farmers. The management indicated their willingness to continue working with farmers and raised the following concerns:

Accessibility to Foundation Community Project especially during rainy periods affect their planning and hence impact negatively on their business. This is because during rainy days, produce from Foundation cannot be transported to the market due to poor accessibility of the road. Harvesting schedules are therefore disrupted, with a negative consequent on project's cash flow. Although the quality of the produce from the project is usually good, it is not always guaranteed. At times it is very difficult to commit a truck to go to procure from smallholders because some of them lie over the phone that the quality is good yet they simply want to sell their produce. As a business, fuel loss of these unwarranted risks is not sustainable.

Quantity is normally not consistent. The first two trips might yield acceptable quantities and quality, but thereafter it's difficult to get good quality and quantity from a specific smallholder farmer. The farmers might then go for three months without any marketable produce and hence such an erratic production and supply pattern is not acceptable in the fresh produce business where consumers need the products on a daily basis.

5.4.3 The role of supermarkets and wholesalers

Supermarkets and wholesalers are wide in terms of products that they trade. Most of the shops trade agricultural commodities like cabbages, spinach, tomatoes and butternut; though as minor products. Retail outlets revealed the challenges of trading with smallholder farmers as their availability and commitment to meet demand of fresh agricultural produce. Several shops including Spar, Boxer Super Stores, Food Town, Kwamadyasi, Emsengeni Wholesalers, Shoprite and Spargs supermarket expressed their views during the data collection process. There are similarities on requirements by retail shops were noticed in the three towns in Mbashe local municipality (Dutywa, Willowvale and Butterworth).

All retail outlets indicated that smallholder farmers face transport problems hence they rarely participate effectively in markets. There are issues around the poor quality of produce and poor commodity grading by smallholder farmers. Willowvale's Frozen Foods supermarket indicated that although they at times procure from smallholder farmers (Foundation Community Project and Ciko Project), the major challenge is grading. Potatoes have always been supplied ungraded, where large and small potatoes are mixed in one pocket. Moreso, the potatoes are not clean, making it difficult to sell the products to consumers, because they are expected as supermarkets to meet certain hygienic standards.

Boxer Super-Store has a centralised procurement system for all products including agricultural commodities in Eastern Cape Province. As such they do not procure directly from farmers. Boxer Super Stores have contracted market agencies based at the East London Municipal Market whose main duty is to source products for all Boxer Supers Stores in Eastern Cape. The main advantage of this is to allow consistent pricing across all branches governed by the same trading policies. Moreso, market agencies offer rebates to Boxer Super Stores, which is calculated based on an agreed percentage of the total gross value spend per year including extra marketing and repackaging costs incurred by the shop. The rebate ranges between 1% and 2% of the total expenditure. This is a great incentive given the perishability nature of the agricultural commodities, where the rebates in a way cover for cost of products that rot on the counter and for breakages. Smallholder farmers cannot pay such rebate which can amount to millions of rands, given the volumes that the whole group demands per year.

There is minimal value addition to agricultural commodities in most supermarkets. Crops are mainly converted into readily consumable products. For example, potatoes are processed into salads, fried and traded as fresh chips in restaurants within the supermarkets. This improves the profit margins gained from potatoes. Cabbages are also transformed into frozen sliced vegetables and salads in retail outlets (supermarkets) and sold at a higher value.

5.4.4 The role of fresh produce markets

The supply of fresh agricultural produce in Mbashe local municipality is dominated by the Butterworth Fresh Produce Market and the East London Municipality Market. The two markets are managed differently and are able to supply the required quantities of products to traders that include: supermarkets, hawkers and fruit and vegetable shops.

The East London Fresh Produce Market

The East London Municipality Market is owned and managed by the Buffalo City Municipality, with four registered agencies operating on the trading floors. The Buffalo City Municipality owns the infrastructure, the administration and cleaning staff. The municipality's responsibilities include:

- Managing the day to day running of the fresh produce market
- Registration of all farmers and buyers who participate in the market
- Ensure efficient payment and accounting systems are followed by agencies and all traders.
- Ensure that levies are collected from all market participants as per the municipality policies and procedures.
- Ensure that all infrastructures including cold rooms, forklifts, weighing scales and all other facilities are always fully functional.

It is important to note the municipality is not directly involved in the trading of commodities, which is a role played by the agencies. Therefore, farmers are directly linked to market agencies through whom they trade their commodities. The four agencies operating at the East London Market include Martin & Scheepers, Border Farmers, Subtropico and AA Market Agency.

Market agencies are responsible for:

- Sourcing produce from farmers,
- Negotiating trading prices for specific with farmers and buyers,
- Operating a trust account into which all their trading finances are paid by the municipality,
- Ensuring that farmers are paid as per agreed schedules,
- Ensuring that untraded produce is disposed in accordance with the rules and regulation set by the market.

There are no standards or policy restrictions governing the participation of farmers at the East London Market. All farmers are free to bring their commodities to the market regardless of size and quantities. On delivery, all suppliers have a consignment docket opened for them. The producer is expected to link with an agent and negotiate price for the produce based on prevailing market prices, quality and grade. The respective agency assumes the responsibility of marketing the produce on behalf of the farmers. Once the produce is bought, the money is deposited into the municipality account before it is transferred into the trust account that is operated by the agencies. For all traded commodities, the Municipality deducts 5% commission and the agencies get a 7% commission, leaving the farmers with 88% of the total revenue. Further charges that vary depending on the quantities that a farmer has supplied include levies for inspection and storage (Cold rooms). The farmers still has to pay transport cost to deliver product to the market, packaging, grading and labour costs. According to the municipality management based at the East London Market, the market costs (commission, cold room fees) and transport cost hinder the participation of smallholder farmers on the market. This is worsened by the fact that their products have to compete with those from well established farmers who often have good quality, packaging, grade and are bulk suppliers to the market. This leaves produce from smallholder farmers overstaying and deteriorating in quality before they are

bought and at times reach a point of disposal at the farmers' expense. The municipality certifies disposal of rotten products together with the agency. Such uncertainties and losses result in smallholder farmers not preferring fresh produce markets as outlets for the commodities.

It is important to note that the East London Market does not operate on contracts with farmers. However, informal relationships are normally forged between the agencies and farmers. Agencies do want to retain as many productive farmers as possible. There are very few government supported agricultural cooperatives participating in the fresh produce market. It was unfortunate that the farmers' database at the East London Market does not give detailed classification of farm size and do not track the consistence participation of individual farmers. Some farmers who last supplied the market more than 6 years ago are still in the records making it difficult to tell whether such farmers are still farming or have changed the marketing channel.

The East London Market also accommodates different buyers, from hawkers, supermarkets as well as fruit and vegetable shops. Hawkers represent the small buyers who normally pay cash for the produce and sell on street stalls and door-to-door. All buyers buy a cash card of R10. The card has a buyer number and a provision for the agencies to record all the quantity and price of the produce that the buyer would have purchased from specific agencies. The buyer would then use this card to pay to the municipality cashier operating at the market. The amount paid is recorded against the respective agencies for determining the commission for the agencies and payment to the farmers. Bulk buyers such as chain shops and some fruit and vegetable shops operate secured cash accounts with the market. The buyers deposit money into their market account and every time they take an order, payment is deducted directly from the account.

The Butterworth fresh produce market

The Butterworth fresh produce market operates using the same concept as the East London Market, but they differ in that the owner, who is renting a private property operate as the agent as well. Procurement is done across South Africa, and a commission between 8% and 12% is charged to farmers depending on the agreement between the farmer and the agency. As such the commission varies per farmer unlike the fixed percentages at the East London Market.

The Butterworth Market also confirmed the non-participation of smallholder farmers on their market; hence most of the suppliers are established commercial farmers. They cited lack of transport, poor quality and low output as major factors hindering emerging farmers from participating on formal markets. Due to private ownership of the Butterworth Market, the trading regulations are at times relaxed to accommodate regular dealers. For instances some hawkers can be given products on credit and pay weekly or fortnightly, to cater for those hawkers without ready cash. This arrangement is mutually beneficial to both the hawkers and the market owner since it increases their sales volumes. However, the same arrangement creates a phenomenon where most of these hawkers are now more or less workers for the fresh produce market since they get produce for re-sale on credit an pay after sale.

5.4.5 Consumer preferences for crop and vegetable products

An analysis of consumer preferences was conducted in Willowvale. The town is a service centre for Ciko and Mbozi villages where the two project sites are based. Both crop and livestock products were investigated as to the consumers' source and the reasons for using specific outlets were noted. The general assumption was that all consumers prouring at Willowvale Town are from within the surrounding communities including Ciko and Mbozi.

Consumer perception and preferences has a great influence on marketing of agricultural commodities. A survey across forty-one (41) consumers around Willowvale was designed to explain where and in what form consumers source their agro-based products for their daily household consumption. Such information is critical in determining the market channel that farmers in rural areas can possibly use to ensure timely selling of their products in large quantities. Table 5.6 below gives a summary of the findings of the consumers' buying frequencies of fresh crop produce.

Table 5. 6: Summary of buying patterns of consumers for crop produce

	Frequency		
Purchase Rate of crop products	**Frequency**	**Percent**	**Cumulative Percent**
Daily	10	24.4	24.4
Weekly	13	31.7	56.1
Fortnightly	6	14.6	70.7
Monthly	12	29.3	100.0
Total	**41**	**100.0**	

More than 50% of the interviewed consumers buy crop produce either daily or on a weekly basis (Table 5.7). This shows availability of demand for fresh crop produce in the area. The same consumers also responded to questions on preferred market channels for the crop produce. The channels being used are presented on Figure 5.6, and generally show that consumers prefer supermarkets to hawkers and farmers.

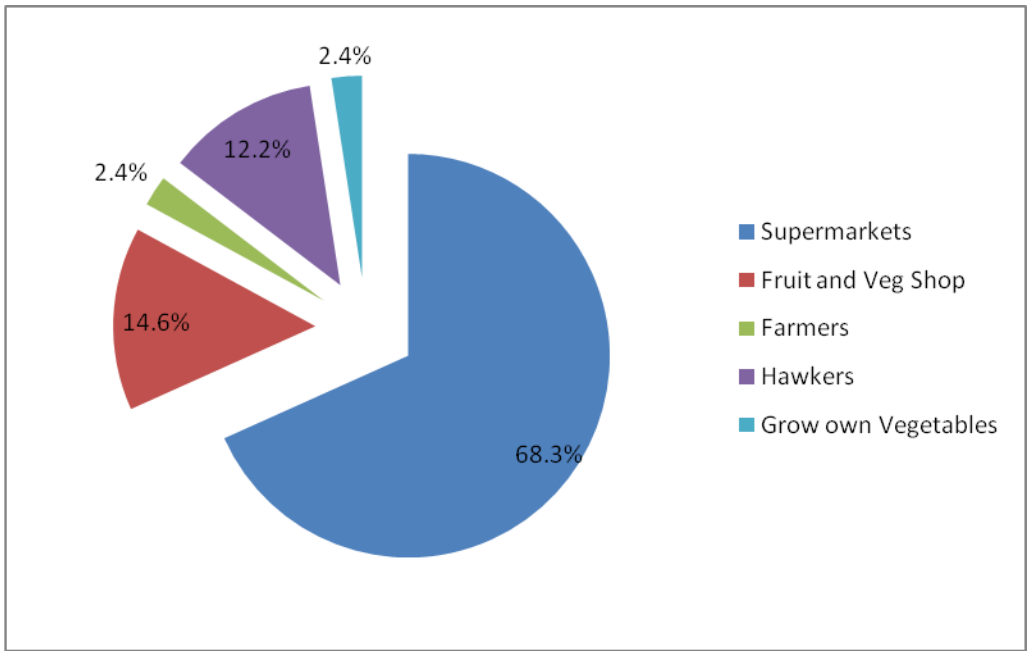


Figure 5. 6: Preferred consumer market outlets for fresh produce (vegetables)

The dominance of supermarkets as preferred outlets for both livestock products and crop produce (Figure 5.6) is significant in informing the smallholder farmers on their target bulk buyers (supermarkets) for their produce. It is however important to note that a strong relationship needs to be forged and all conditions including quality requirements, delivery and consistency of supply guaranteed for mutual benefits, between smallholder farmers and supermarkets. The role of fruit and vegetable shops and hawkers seem not to be consistent with expectations as major sources of fresh produce for the consumers. An interview with a consumer revealed the following:

> "I don't buy from hawkers because they do not sell fresh products. Their products are always exposed to the sun and at times can go for days before they are sold making them stale. You can't get small units as well, especially of cabbages. You end up buying a full cabbage even if you would have preferred a fraction of it. That is why I use the supermarkets because you can find them packed into halves or quarter, which is enough for my family"

The sentiments by consumers highlight the importance of quality and product differentiation to meet needs of a wider consumer base. The availability of cabbages in smaller sizes is accompanied by an extra per unit cost, which consumers tend to neglect. During the data collection period (August 2010), a full cabbage had a retail price range between R6.99 and R9.99, while half packed cabbages were costing between R4.99 and R7.99. However, due to the need by consumers to buy products that they can consume and finish whilst they are still fresh, consumers are prepared to pay extra for the repackaging and value addition costs that supermarkets incur.

Consumers indicated that they know of irrigation schemes around Willowvale town, but they are not prepared to walk or use a taxi to go and buy vegetables from the schemes. This is costly and hence irrational for most consumers even if they would get cheaper products. They cited distance and time as the major deterrent factors in buying directly from agricultural projects.

5.5 Factors impacting on crop value chains associated with irrigation projects

5.5.1 Crop value chain enablers and drivers

Communication networks

While market participation by farmers signifies their aspiration to participate in specific commodity value chains, most smallholders have indicated that their chains are short and rarely cross beyond their administrative boundaries. The major enabler to the cabbage and maize value chain in both Ciko and Foundation Community project is a telephone network system that can be used to the advantage of the farmers. The two projects have indicated that they use their mobile phones to contact potential buyers and advertise their produce. It is also anticipated that their clients can as well phone them in search of products for the market and for household consumption.

Demand

Demand for fresh produce is another major driver for both the cabbage and the maize value chain. The two irrigation projects have a market at Willowvale and Dutywa that can promote their farming business in the long run.

Water supply

Reliable water supply for irrigation from the Shixini River ensures good quality maize and cabbage produce if fully utilised. The two projects only incur pumping costs and no water levies are paid, hence must have a higher competitive advantage in producing crops under irrigation.

Land availability

Free access to land offers a good growth potential for both Ciko and Foundation Community project. In the case of Foundation Project, a total of 66ha is freely available for expansion purposes. If these farmers can be supported technically and financially, growth is possible.

5.5.2 Crop value chain barriers and regulators

Transportation

Transport availability is greatly inhibiting farmers' effective participation in commodity value chains. Both Ciko and Foundation Community Project have neither trucks nor trailers to transport their produce to the market. This has worked against the farmers' aspirations to increase their marketing of crop produce.

Road accessibility

Road accessibility is also a major factor affecting smallholder farmers. When Foundation Community was launched in 2007, a business relationship existed between the project and Georges Fruit and Vegetable Shop, who used to sent their truck to collect fresh produce from the scheme. This trading relationship has collapsed due to poor road condition and slowly declining yields emanating partly from lack of market.

Lack of technology

Lack of technology like potatoe washing equipment, dibblers and seedling trays is also affecting farmers at the Foundation Project sites. The value chain mapping has also shown more returns from processed vegetables than trading raw cabbage. However, farmers are not able to lengthen the cabbage value chain due to lack of processing sheds, cold rooms and electricity at the project site.

Competition

Competition has affected Ciko and Foundation projects, on the Willowvale market. Whilst the demand for the produce is there, established businesses procure the bulk of their fresh produce from East London Municipality Market, where they claim to get better quality and quantity than the nearby community projects. This is threatening the viability of the two irrigation schemes.

Institutional support

Poor cooperative governance systems are also affecting project viablity. For instance, Ciko Community Project has a grant of R240 000 and Foundation Community Project has R345 000, from the Department of Social Development, which they cannot use to buy a tractor, trailer or a delivery truck to improve their performance. The money can only be used to pay for inputs and no extra labour can be hired using the money. Though there is need for control on project funds, the need to develop a holistic support structure for farmers cannot be ignored. Such a support must allocate funds for all the stages of production from input procurement, farming, harvesting, value addition and marketing of the produce. Currently, most support from government departments is concentrated on production and putting irrigation infrastructure on project sites without a follow-up on marketing of the produce.

5.6 Beef cattle value chain

For many rural poor, livestock provide a small but steady stream of food and income. It help raise whole farm productivity and are often the only way of increasing assets and diversifying risks (Otte, 2006). In addition, livestock have an important role in improving the nutritional status of low-income households, confer wealth status, are of cultural importance and create employment opportunities beyond the immediate household (Otte, 2006). Figure 5.7 shows a possible mapping of the beef value chain.

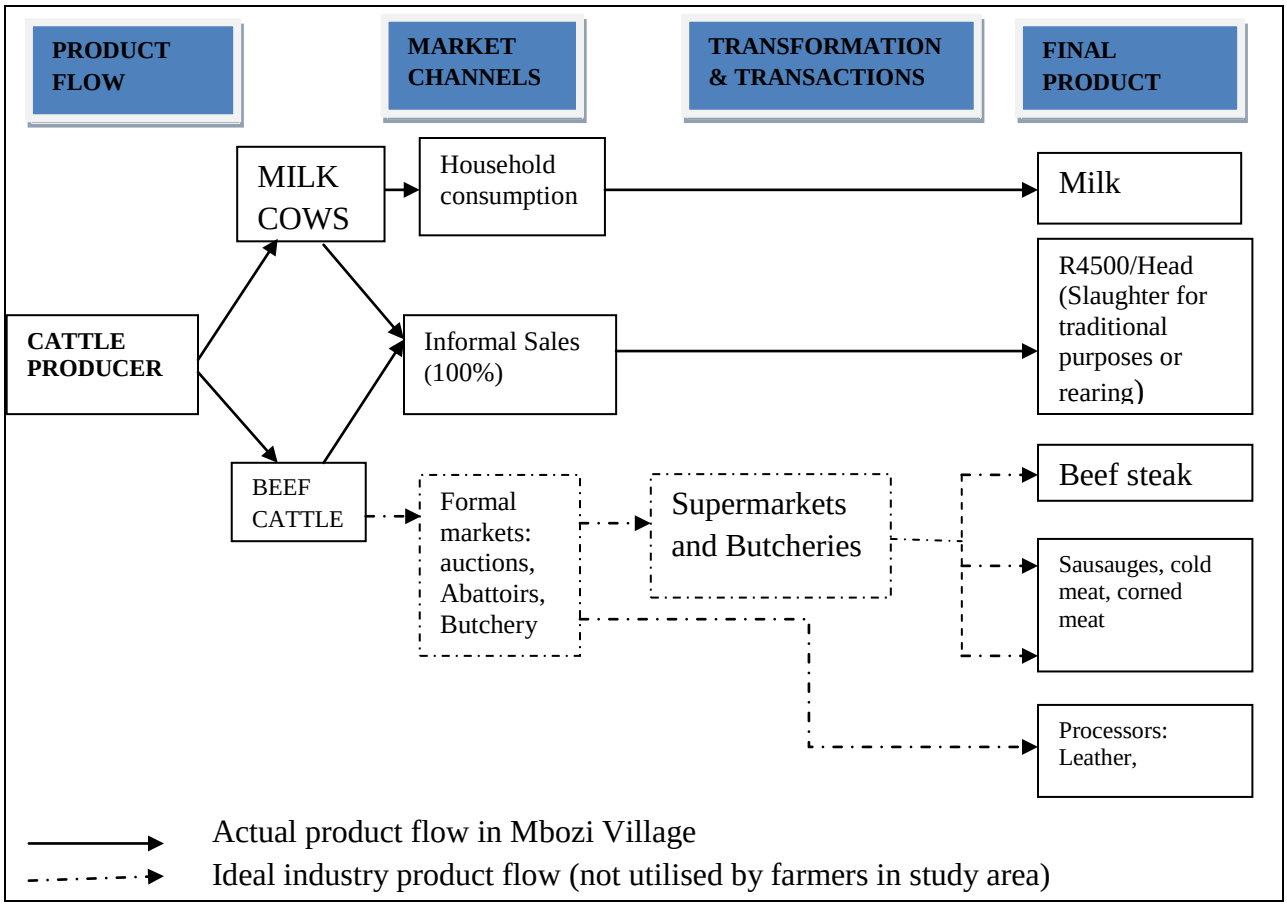


Figure 5. 7: Flow of Beef cattle produced at Mbozi and Ciko Communities

5.6.1 Cattle Input supply system

Communal farmers rely less on modern livestock vaccines. Mostly cattle chemicals were purchased from Umtiza Farmers Co-op and Emsengeni Wholesale trading as Build-It Hardware at Willowvale town. Table 5.8 gives a summary of the inputs in extensive cattle rearing at household level in Ciko and Mbozi villages.

5.6.2 Farm production (including water use)

Cattle rearing in Ciko and Mbozi communities are done by few people (Table 5.7). A survey of 82 households revealed the following cattle ownership statistics:

Table 5. 7: Cattle ownership in Mbozi and Ciko Communities

Variable	**Quantity**
Sampled Households (N)	82
Number of household without cattle	61 (74.4%)
Number of households who own cattle	21 (25.6%)
Average herd size	4.8 =5 (min=1, max=15)
Farmers who have marketed their cattle the previous season	2 (one animal per farmer)
Selling price per head	Prices obtained: 4000 (3 years old); R5000 (4 years old)
Water Consumption until the animal is sold (@45 litres/animal/day)	3.5yearsx12monthsx30daysx45litres 56 700litres/animal = 56 700 litres Approx 16 200 litres/year/livestock unit
Labour (one unit/day) @ farm rate of R40/day	Most families use family labour whom they do not attach any financial value)
Dipping	• The community relies on Ciko community dip tank. • No dipping levies are paid. • Dipping is coordinated by a communal animal health technician with assistance from the dipping committee. • Dipping chemicals are for free and supplied by the government. • Farmers also buy dip and do private dipping using knapsack sprayers at homes.
Vaccines	R200/animal/year (farmers also use their cheaper traditional medicines for livestock)
Grazing	No payment-Free access

The community relies heavily on communal dip tanks to control pests and insects on cattle. Traditional remedies are also used where farmers are budget constrained and when the indigenous medicines are readily available.

Water for livestock is mainly from small earth dams constructed in the villages and the network of rivers that include Shixini River, Mbozi River, Ciko River and Qwaninga River. However, grazing is restricted by the steep terrain within the two villages. Sheep production is reportedly minimal due to this reason.

5.6.3 Cattle processing

Currently there is no processing of livestock products in the communities. Meat processing is highly specialised and well established certified abattoirs are mostly involved in livestock product processing.

5.6.4 Cattle markets and prices

Low participation of smallholder farmers in cattle value chains emanate from their low market off take and high purchase price. Of the two farmers who sold their cattle, one had 10 cattle and the other had 2 cattle at the time of selling. Both farmers cited family problems like funerals as the reason for selling of cattle. This shows that cattle rearing ventures among smallholder subsistence farmers are not yet regarded as a farming business with great potential to earn households income. However, farmers also cited high mortality rate of cattle due to pests and diseases; hence their herds have decreased, making livestock marketing impossible.

Marketing channels used by farmers differ greatly across municipalities depending on the needs of the farmers. In South Africa most rural farmers have five marketing channels in which they can market their cattle, which are auctions, butcheries, private sales, speculators and abattoirs (Montshwe, 2006).

A number of cattle market outlets are available to the cattle farmers; however, access to formal markets is limited by a number of factors, chiefly of which are the distance from the market and

inadequate infrastructure. Dominant market channels include private sales, auctions, butcheries and abattoirs (Figure 5.9).

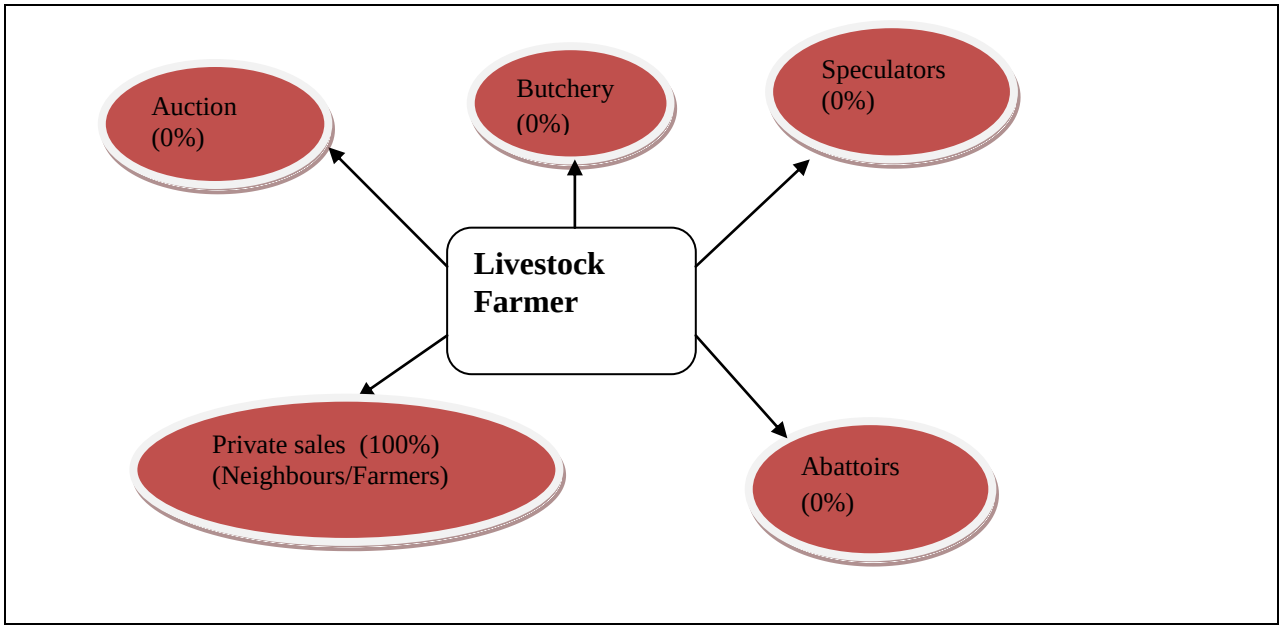


Figure 5. 8: Cattle marketing channels in Mbozi and Ciko Communities.

The study noted that cattle farmers in Mbozi and Ciko communities rely on private sales among themselves. The cattle numbers are very low (minimum=1, maximum =15 per household) hence cattle marketing is not that active in the area. A study contacted in Chris Hani, Alfred Nzo and Amatole district municipalities indicated that auction is the most common channel used by farmers in Chris Hani and Alfred Nzo, while in Amatole private sales are the most commonly used channel (Musemwa, 2008). The current study is consistent with the findings of the Musemwa study, in that Mbozi and Ciko villages are located in Amatole, and utilise private sales for their cattle. This has a policy implication if cattle markets are to be enhanced in Amatole District Municipality of the Eastern Cape Province.

5.6.4.1 Auctions

Livestock auction markets are established places of business where livestock are assembled at regular intervals and sold by public bidding to the buyer who offers the highest price per head (Nkosi and Kirsten, 1993). These markets are public markets open to all buyers and sellers. As indicated by the NDA (2005), buyers include individuals buying for household use, butchers, commercial farmers and speculators. Nguni cattle, is a traditional breed and can also be sold at better prices as breeding stock to breeders, commercial farmers and other communal farmers. The number of cattle sold through auctions varies considerably between locations. This influences the number of prospective buyers which in turn may affect the prices paid for cattle at a particular market (Benson et al., 2001). In the case of the Nguni, the Nguni Breeders Association do advertise these auctions, the prices paid in such auctions are very high compared to convectional auctions where all breeds of cattle are sold (Nkhori, 2004).

5.6.4.2 Private sales within the community

The shortest, simplest and most popular option, especially amongst smallholder livestock owners, is private sales directly to the ultimate consumer (Nkosi and Kirsten, 1993). Private sale occupies an important position in the livestock marketing arena of the emerging sector. Private sales include individuals buying livestock for different reasons which include slaughter, investment or for socio-cultural functions such as funerals, weddings, customary and religious celebrations (USAID, 2003).

Due to the important functions performed by livestock in African societies, there exists a market amongst individual households (Nkhori, 2004). Private selling is a common practice to communal farmers as they are in a position to determine prices for their animals. In addition, farmers incur less low marketing costs. Private sales are therefore, the cheapest and most probably, the simplest form of market outlet. Nkhori (2004) also reported that on-farm or direct sales to the consumer offer the greatest profit margin on live animals for the producer because all middlemen and their fees are eliminated. It offers a year-round marketing outlet; however the

demand is irregular with high demand during certain times of the year, like festive seasons and Easter holiday. Most of the cattle traded in these informal markets are primarily old oxen destined for service as draught animals and ultimately for slaughter (Swallow and Broken, 1987).

The respondents in the Musemwa study indicated that most of the cattle sold through private sales were mainly for functions such as family gatherings, funerals and weddings (Musemwa, 2008). The farmers indicated that they are dissatisfied with the use of this channel because of the delays in payment. Despite these drawbacks, the respondents indicated that private selling is the cheapest and simplest form of marketing cattle since the buyer just comes and buys from the seller's kraal thereby saving the seller transport costs and the buyer determines the price (Musemwa, 2008).

5.6.4.3 Butcheries

Another available option to communal farmers is to sell cattle directly to the butchery. Butcheries provide basic marketing services for farmers, particularly communal farmers, who are unable to market their cattle efficiently and profitably through other existing formal channels. Butchers enhance the marketability of livestock by acting as buyers in their own right and by acting as buyers at auctions. Nkhori (2004) found that good prices and farmers having a strong bargaining power in determining the prices of their stock are the main reasons for some farmers' satisfaction with sales to butchers. Though literature has indicated much support for butcheries, typical rural communities like Mbozi and Ciko Communities in Eastern Cape Province have no standard butcheries that can meet the requirements for slaughter houses. The three butcheries at Willowvale town all get their meat from Mthatha abattoirs, Kgomga Distributors and East London abattoirs.

5.6.4.4 Abattoirs

It is important to note that the Musemwa study revealed that less than 6 percent of the farmers in the three municipalities used abattoirs as a marketing channel. There might be a need to investigate the limiting factors to farmer participation on such specialised markets like abattoirs. Abattoirs pay farmers according to age, weight and grade of the animal. This grading system under-value certain indigenous breeds, where exotic breeds fetch higher prices than the traditional breeds. However, abattoirs tend to sell natural beef at high prices at both local and international markets than genetically modified beef and this result in them getting higher than normal returns at farmers' expense (Musemwa, 2008).

According to the NDA (2005), the abattoir is the least used marketing channel by communal farmers because of factors which include distance from the producers, slow speed of payments, high risk factor of animals being condemned on the basis of health status, and many charges involved in using this channel. It is not economical to sell one or two animals as transport costs will not be justified. Group marketing can assist farmers to enjoy economies of size when using this channel. However, group marketing is not always possible since farmers sell their animals at different times. The ability to sell stock at market-related prices would translate small scale farmers' cattle base into a capital base and improved livelihoods.

5.6.4.5 Consumer preferences for livestock products

Table 5.8 below gives a summary of the findings of the consumers' outlet preferences for meat products.

Table 5. 8: Summary of buying patterns of consumers for meat products

	Frequency		
Purchase Rate of Meat products	Frequency	Percent	Cumulative Percent
Daily	12	29.3	29.3
Weekly	13	31.7	61.0
Fortnightly	5	12.2	73.2
Monthly	11	26.8	100.0
Total	41	100.0	

The survey shows that about 61% of the consumers buy meat products daily or on a weekly basis (Table 5.7) signifying the availability of market for livestock products.The survey also indicated that consumers mainly rely on supermarkets for their daily livestock products requirements (Figure 5.8), with 78% of the respondents indicating their preference of this channel. Consumers cited reliability and good quality of meat products in most supermarkets. However, it is expected that consumers get their meat products from butcheries more than supermarkets. This can be partly explained by the fact that in supermarkets, consumers buy a wider range of dailies like bread, sugar, salt and juice, which are not found in butcheries. More so, there is the opportunity to pick and choose from a range of livestock products that include beef, mutton, mince meat and sausages, which are not found in the small butcheries at Willowvale town.

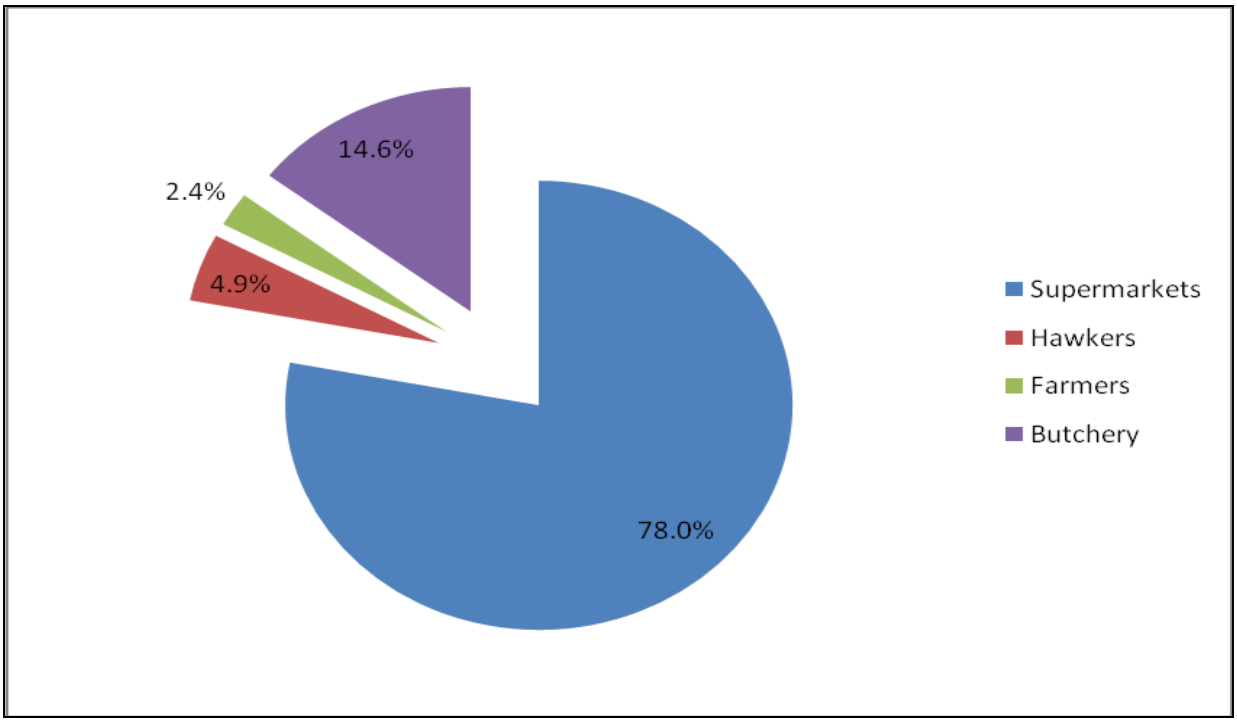


Figure 5. 9: An illustration of preferred consumer outlets for meat products

It is important to note the low participation of hawkers and farmers in meat trading, with 4.9% and 2.4% of the consumers indicating that they use these sources respectively (Figure 5.9). This finding is consistent with expectations, due to the regulatory framework that controls the trading of uncertified meat products. Some consumers revealed that some households sell meat only after slaughtering their animal, and hence part of it is sold to raise some income. This is however a once off phenomenon per household and consumers cannot rely upon.

In summary, smallholder farmers must be integrated with the retail businesses for them to tap into that market. The preference of consumers to procure from retail suppliers instead of directly from farmers shows the need for farmers to forge relationships with supermarket owners to improve their fresh produce marketing.

5.7 Summary of factors impacting on cattle value chains

5.7.1 Cattle Value Chain Enablers and drivers

Free access to grazing facilities

Grazing is not paid for in Ciko and Mbozi villages. Moreso, there is no restriction to herd size per household as a way to control over grazing. This gives room to potential farmers to increase their cattle numbers for future marketing.

Availability of dipping facilities

Communal dips are easily accessible in the area and are located along the perennial Shixini River. This makes refilling and changing the dip much easier for the community. Better pest control is therefore expected, that must consequently increase livestock productivity.

Perennial Water Supply

Drinking water for cattle is readily available in Ciko and Mbozi communities. Cattle graze along the rivers and hence do not travel long distances to look for water.

5.7.2 Cattle value Chain Barriers and regulators

Restricted grazing

Grazing is restricted by steep terrain within the two villages. There are some areas which are not reachable by cattle and this leaves only a small area available for livestock grazing.

Animal pests and diseases

Cattle owners in the two villages complained of tick infestation despite dipping their cattle regularly. An investigation into the efficacy of the current dipping chemicals (Tritix dip) and its mixing rates is worth considering

Cost of purchasing livestock

About 70% of the villagers do not own cattle. The major reason is due to the cost of buying a cow for rearing purposes. They actually consider someone who can afford to buy a cow as rich.

Distant Auctions

There are no nearby auctions in the village to motivate farmers to sell their cattle at competitive price values. Rural farmers might not be familiar with the operation of cattle auctions.

Small herd size and low market off-take

The minimum herd size is 1 and maximum of 15 cattle in the combined survey of Ciko and Mbozi Villages. Such small herd sizes are a deterring factor to cattle marketing.

5.8 Chapter summary

The major objective of the study is to map value chains for maize, cabbage and cattle enterprises. All value chains under study indicated that they are short and no processing of products is taking place within Mbozi and Ciko Communities. As cabbages and maize move from the farm to retail outlets, value addition start to take place through transportation to the market and processing in supermarkets.

Whilst concrete value chains could have been drawn, lack of important data limited the scope of the study. Data on yield levels for all enterprises was not readily available due to poor record keeping at farm level. These same applies on daily production expenditures, input procurement costs, number of hours worked per enterprises and quantities sold to specific markets. This is actually a learning curve, especially in developing farmer support programmes. Record keeping, agronomic courses and financial management courses strongly need to be incorporated in farmer support programme.

CHAPTER 6

PRESENTATION OF QUANTITATIVE RESULTS

6.1 Introduction

The chapter presents the main research findings on variables that affect technical efficiency of maize, cabbage and cattle production. The section tries to recommend possible policy direction towards improving smallholder participation in competitive value chains. A cross-tabulation of variable factors that affect famers' needs and aspirations in food value chains was performed, followed by an econometric assessment of the determinants of smallholder technical efficiency at farm level.

6.1.1 Factors affecting farmers' needs and aspirations in agricultural participation

The aspiration of households and their goals in agricultural participation is weighed against such variables as location of the household (village), membership of the household to any one of the irrigation projects in the area as well as the household's major sources of income. A non-parametric correlation model was used to establish whether there exist some relationships between selected marketing and production variables presented on Table 3.1. Specifically, the two-tailed Pearson's correlation analysis was computed to indicate the strength and direction of the linear relationships (Tables 6.1).

Table 6. 1: Pearson Correlation matrix

		Village	Project Membership	Income Sources	Major Goals	Production Aspiration	Market Aspiration
Village	Pearson Correlation	1	-.026	.142	.241*	.113	.028
	Sig. (2-tailed)		.815	.204	.029	.310	.804
Project Membership	Pearson Correlation	-.026	1	.008	.249*	-.107	.033
	Sig. (2-tailed)	.815		.944	.024	.338	.769
Income Sources	Pearson Correlation	.142	.008	1	.208	-.163	-.160
	Sig. (2-tailed)	.204	.944		.060	.143	.152
Major Goals	Pearson Correlation	.241*	.249*	.208	1	.207	-.057
	Sig. (2-tailed)	.029	.024	.060		.062	.610
Production Aspiration	Pearson Correlation	.113	-.107	-.163	.207	1	.156
	Sig. (2-tailed)	.310	.338	.143	.062		.161
Market Aspiration	Pearson Correlation	.028	.033	-.160	-.057	.156	1
	Sig. (2-tailed)	.804	.769	.152	.610	.161	

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

One of the aims of the study is to explore possible association between household variables and farmers' aspirations in carrying out agricultural ventures. Six major contributors to the association were assumed and correlation tests were done for all the targeted variables. The variables include: location of the household(Village), household income sources, farmers' major goals, farmers' intention to market his/her agricultural produce and farmers' aspirations to increase agricultural production.

The assumption was that village of origin has an influence in farmers' participation in agricultural activities hence have an overall effect on the households' goals and aspirations. The results on Table 6.1 indicate that there is positive correlation at 0.05 level of significance, between "village" and major goal of the household, where goals are sub-divided into marketing,

consumption and cultural goals. These goals specify the reasons why specific households participate in crop or livestock activities. This is important in informing policy on specific aspects that might need to be addressed at village level.

At 0.05 significant level, household membership to any of the two irrigation projects (Ciko and Foundation community project) is positively correlated to the households' major goal. It is important to note that while membership of irrigation project has a positive correlation to goals of the farmer; there is no relationship with the farmers' aspiration to increase production or to market. This could be due to the fact that farmers have regarded individual household farming and collective farming at the project as completely independent ventures. The separation of the two distorts what could have been a learning curve for the farmers by practicing what they learn through their involvement in the project (marketing of produce) and apply it at individual household level.

Household Income sources were also considered to have influence on farmers' goals. Survey data indicated that 80.5% of the households receive government social grants as their major sources of income. No household in both communities indicated agriculture as a major source of income. As such, Pearson's correlation coefficients were negative in relation to households' aspiration to increase production or to market their agricultural produce (Table 6.1). A positive correlation could have been anticipated if farmers relied on agriculture as the major source of income.

Market aspiration by farmers is negatively correlated to their goals, which is mainly consumption, as well as negatively correlated to their aspiration to increase production (Table 6.1). Both Ciko and Mbozi households are operating at subsistence level in terms of hectarage (mean=2.76hectares for rain-fed outside fields and 0.71hectares for homestead gardens) and weak market participation, where major goal of the community is consumption.

The farmers' consumption goal negatively affects their production levels. Where marketing is the major goal, an increase in production is anticipated, and decreases where the goal is consumption like in Ciko and Mbozi communities. Policies therefore need to target reorientation of the farmers' perception on agriculture, so that a positive correlation can be realised between

their goals and increase in production. Increased production is expected to have a positive spillover effect on the potential participation by farmers on formal markets.

6.2 Stochastic frontier model results

The value chain approach to economic development and poverty reduction involves addressing the major constraints faced and opportunities available to farmers and producers, processors, traders and other businesses at multiple levels along the value chain. Therefore, an analysis of the determinants of efficiency is very important as a basis for informing agricultural policy on what needs to be done to improve smallholder productivity (Tchale, 2009). The stochastic frontier analysis was performed separately for maize, cabbage and cattle enterprises. This was done to determine enterprise specific factors that determine efficiency at farm level. Technical efficiency variables were analysed using household data and hence these farmers were regarded as independent decision making units (DMUs).

6.2.1 Determinants of technical efficiency among smallholder cabbage farmers

Table 6.2 presents variables that were assumed to have an effect on cabbage production efficiency. The crop production efficiency is charaterised by the total value of crops grown at household farm level measured against input cost levels and household socioeconomic factors such as educational level and farm labour. The stochastic frontier analysis also took into account market related variables as potential determinants of production efficiency. These include quantity of cabbage traded (cabsolkg), market channel (cabmark), market satisfaction (cabmarksat), form in which cabbage is sold (cabselform) and cabbage price (cabprice).

Data for 82 households that produce cabbages was used to explain the determinants of technical efficiency among smallholder cabbage producers (Table 6.2).

Table 6. 2: Determinants of technical efficiency among smallholder cabbage farmers

Cabbages harvested	Coef.	Std. Err	Z	P>|z|	[95% Conf. Interval]	
Number of Farm labour	1.252143	0.8048144	1.56	0.120	-.3252645	2.82955
Education level	1.261461	1.230084	1.03	0.305	-1.14946	3.672381
Household Total land Owned	-0.4069319	0.3942264	-1.03	0.302	-1.179601	.357376
Number of ploughs owned	0.6528304	3.463456	0.19	0.850	-6.135418	7.441079
Rainfall adequecy	3.565982	1.99007	1.79	0.073*	-.334483	7.466447
Use of rainwater harvesting techniques(Rwht)	-1.419615	1.834271	-0.77	0.439	-5.014719	2.17549
Cabdage input cost	0.0020158	0.0009718	2.07	0.038**	.0001111	.0039205
Cabbage sold in kgs	1.128142	0.4313733	2.62	0.009***	.2826659	1.973618
Cabbage market channel used	44.16954	12.88487	3.43	0.001***	18.91566	69.42343
Form in which cabbage was sold	-61.66678	18.06003	-3.41	0.001***	-97.06379	-26.26976
Cabbage market satisfaction	0.470661	3.046362	0.15	0.877	-5.500098	6.44142
Cabbage price per head	-.9460262	1.82409	-0.52	0.604	-4.521178	2.629125
-cons	-6.5884	32.44345	-.020	0.839	-70.1764	56.9996
/Insig2v	4.373137	0.1585113	27.59	0.000	4.062461	4.683814
/Insig2u	-5.217539	1091.042	-0.00	0.996	-2143.62	2133.185
Sigma_v	8.904607	0.7057405			7.623461	10.40105
Sigma_u	0.0736251	40.16402			0	.
Sigma2	79.29744	12.94344			53.92876	104.6661
lambda	0.0082682	40.29068			-78.96001	78.97655

Likelihood-ratio test of sigma_u=0: chibar2 (01) =0.00 Prob> = chibar2 = 1.000, n=82

*, **, *** Indicate statistical significance at 10%, 5% and 1% level, respectively

The results (Table 6.2) shows that the determinants of technical efficiency and the marginal effects or partial elasticities show the percentage change in technical efficiency that results from a unit change in each variable. Rainfall adequacy (enourain) is significant at the conventional level of cabbage production. Rain elasticity is 3.56 suggesting that a 1% increase in rainfall received in the area can boost overall cabbage production performance by 4%. Other positively significant determinants of technical efficiency in cabbage production include cabbage input cost, quantity of cabbage sold and market channels used by farmer (Table 6.2). The form in which cabbage is sold at farm level is negatively related to farm efficiency. This can explain the non existence of processing of cabbages at smallholder farm level. Processing facilities at smallholder level can be considered as non-viable option given the low levels of cabbage output; hence it can be regarded as irrational and inefficient for a smallholder farmer to own processing units.

The parameter estimate for farm labour (farmlabo) turned is statistically insignificant, which was contrary to the apriori expectation. This implies that farm labour usage has no significant effect on productivity in the cabbage enterprise. The possible reason for the this could be the aggregation of labour over various crops enterprises including those not covered in the analysis. When such an aggregation occurs as is the case with smallholder farmers, the challenge is to account for specific labour usage per enterprise, which might have a bearing on the quality of data collected.

6.2.2 Determinants of technical efficiency among smallholder maize farmers

The stochastic frontier analysis was performed on eight independent variables to determine their influence on smallholder maize production efficiency. Maize harvest (maizharskg) was regressed against a set of independent variables presented in table 6.3, whose effect on farm efficiency varied. In this analysis maize harvest is taken as yield levels or levels of production for household farms (Decision making units-DMUs). Data was taken for all the sampled 82 household that grew maize at their household farms.

Table 6. 3: Determinants of technical efficiency among smallholder maize farmers

Maize harvested in kg	Coef.	Std. Err	Z	P>|z|	[95% Conf. Interval]	
Rainfall adequacy (enourain)	40.93337	16.856	2.43	0.015**	7.896209	73.97053
Maize price	1.955839	.8510684	2.30	0.022**	0.2877757	3.623903
Area under maize (ha)(maizeareaha)	89.12573	32.86737	2.71	0.007***	24.706888	153.5446
Use of rainwater harvesting techniques(Rwht)	-23.00497	24.38158	-0.94	0.345	-70.79199	24.78204
Maize market	1.153245	95.48909	0.01	0.990	-186.0019	188.3084
Maize selling form	-11.26295	105.7875	-0.11	0.915	-218.6027	196.0768
Education level	10.59989	9.594923	1.10	0.269	-8.20581	29.4056
Maize market satisfaction	24.29776	103.6751	0.23	0.815	-178.9018	227.4973
-cons	-20.97345	134.2939	-0.16	0.876	-284.1846	242.2377
/Insig2v	8.504738	0.1561824	54.45	0.000	8.198626	8.81085
/Insig2u	-5.305367	4472.848	-0.00	0.999	-8771.927	8761.316
Sigma_v	70.27168	5.487599			60.29885	81.89393
Sigma_u	0.0704619	157.5826			0	.
Sigma2	4938.114	771.3331			3426.329	6449.9
lambda	0.0010027	157.737355			-309.1549	309.1569

Likelihood-ratio test of sigma_u=0: chibar2 (01) =0.00 Prob > = chibar2 = 1.000, n=82

*, **, *** Indicate statistical significance at 10%, 5% and 1% level, respectively

Rainfall adequacy (enourain), maize market price (maizprice) and area under maize (maizareaha) indicated their high strength in determining production efficiency at 5% and 1% level of significance respectively. Given that farmers indicated that they do not measure rainfall received at a point and time, their perception on whether the rainfall is adequate to meet maize demands was used. As such farmer perceived that a marginal increase in rain rainfall in the area can cause an increase in the levels of production. This can therefore inferred to an increase in technical efficiency by farmers. A marginal increase in price and area under maize will increase efficiency by 2% and 89% percent respectively. It is important to note that while an increase in rainfall has a positive effect on technical efficiency, the farmers in the study area have not adopted some infield water harvesting techniques (rwht) like mulching, use of infield ponds and infield wells to

supplement water on crops. Given that water is critical as a productive resource it is important to explore strategies to improve its utilisation by farmers at smallholder level.

The fact that the communities have realised that rain water has to improve so that they can realise more maize yield leaves a gap to be filled in terms of adoption of infield water harvesting techniques. It was anticipated that since rain water directly affects maize production efficiency, smallholder farmers would as well respond positively to infield water harvesting techniques. The descriptive profiling of farmers actually indicated that only 5% use mulching to conserve moisture and 95% either don't know about the techniques to conserve infield water or they just don't apply them. This poses a challenge to agricultural development planners, whose aim is to increase household food production in the face of limited resources like irrigation infrastructure and water.

6.2.3 Determinants of technical efficiency among smallholder cattle farmers

A further analysis of determinants of efficiency in cattle production was performed and results presented in Table 6.4. The model adopted cattle revenue or cattle numbers as dependent variable, and technical efficiency at farm level was assumed to be influenced by education level, farm labour availability, rainfall adequency and a set of market variables (Table 6.4). Data for twenty one (21) household that produce cattle was used to analyse the determinants of technical efficiency.

Table 6. 4: Determinants of technical efficiency among smallholder cattle farmers

Cattle Revenue	Coef.	Std. Err	Z	P>|z|	[95% Conf. Interval]	
Number of Plouqhs per household	2625.258	2550.512	1.03	0.303	-2373.654	7624.17
Cattle market	4594.662	1394.283	3.30	0.001***	1861.918	7327.406
Cattle marketing form (live or slaughtered)	549399.6	124095.5	4.43	0.000***	306176.9	792622.4
Cattle market satisfaction	-732193.9	165766.3	-4.42	0.000***	-1057090	-407298
Cattle price	44.81113	9.045565	4.95	0.000***	27.08215	62.54012
Use of water harvesting techniques(Rwht) eg Dams	-335.585	1257.326	-0.27	0.790	-2799.899	2128.729
Rainfall Adequecy(enourain)	1963.577	1344.446	1.46	0.144	-671.488	4598.643
Farm labour availability	935.9701	514.0329	1.82	0.069*	-71.51594	1943.456
Education level of household head	704.2812	852.8846	0.83	0.409	-967.3419	2375.904
-cons	-5428.932	23355.75	-0.23	0.816	-51205.36	40347.49
/Insig2v	17.42841	.1561738	111.60	0.000	17.12231	17.7345
/Insig2u	-5.215058	786186.1	-0.00	1.000	-1540902	1540891
Sigma_v	6088.785	475.4542			5244.719	7095.75
Sigma_u	.0737165	28977.44			0	.
Sigma2	3.7000007	5789877			2.57e+07	4.840007
lambda	.0000121	28981.47			-56802.63	56802.63

Likelihood-ratio test of sigma_u=0: chibar2 (01) =0.00 Prob> = chibar2 = 1.000, n=21

*, **, *** Indicate statistical significance at 10%, 5% and 1% level, respectively

The model highlights the importance of market variables in influencing technical efficiency in cattle production. Cattle market channels (cattmark), cattle market satisfaction (cattmarksat) and cattle market price (cattprice) are significant determinants of technical efficiency in cattle production at 1% level of significance. The dominance of informal cattle trading among farmers in the study area can be a possible reason for a negative coefficient between cattle revenue (cattrevenue) and cattle market satisfaction (cattmarksat). The negative coefficient on market satisfaction was due to minimum marketing of cattle by respondents in the study area. Strategies can therefore be directed towards formalising cattle markets through establishing market auctions in the area. The assumption is that farmers' production patterns would respond to

competitive forces like high prices and bargaining power exerted by the markets to increase their livestock numbers, *ceteris paribus*.

Cattle farmers in the study area indicated their over reliance on private cattle sales to neighbours and have very little knowledge about auctions. In fact, none of the interviewed farmers had participated on cattle auctions or sold cattle directly to registered abattoirs before. However, farmers have indicated their willingness to be exposed to such unfamiliar markets.

Farm labour (farmlabo) is also significant (p=0.069) in influencing cattle production efficiency. Farm labour is a major input and hence is a measure of input use efficiency. Cattle operations like herding, milking and watering are daily activities, hence the emergence of farm labour as a significant variable.

The study area is serviced by a perennial river (Shixini River) which caters for livestock water requirements. This explains why water adequacy (enourain) and use of rain water harvesting techniques (rwht) like earth dams are not significant in cattle production. The area is endowed with the major resource (water), but the potential of the area to increase livestock production lies on land availability and the condition of the veld. This requires a separate study before recommendations can be made.

6.2.4 Chapter Summary

The chapter build on from previous chapters by examining the determinants of farm-level technical efficiency at smallholder level. The specific objective of the chapter is to assess farm-level technical efficiency indicators and ascertain the determinants of efficiency. Results of the study indicated that efficiency of different enterprises is influenced by a wide range of factors. The efficiency of smallholder cabbage production is influenced by input cost, quantity traded at any given time, rainfall adequacy and the market channel used by the farmer. On the other hand, maize production efficiency greatly depends on area planted, maize price and rainfall adequacy as well. Smallholder cattle production is directly influenced by farm labour availability, cattle price, market satisfaction and market channels used by the farmers.

CHAPTER 7

SUMMARY AND RECOMMENDATIONS

7.1 Introduction

The dissertation broadly covered the issues around agricultural commodity value chains with a main focus on smallholder agriculture. An attempt was made to review relevant material on the subject matter and apply the findings within the smallholder context in Eastern Cape Province of South Africa. A background profiling of smallholder agriculture was done as a means of identifying their major goals in agriculture production and marketing. While irrigation farmers show much market orientation in their production, it is different with smallholder rainfed farming whose major goal of production is household consumption. Value chain mapping was also done for specific commodities and the determinants of production efficiency at farm–level analysed. It is important to note that although the focused on farm-level analysis, value chain analysis goes beyond the farm level. It draws attention to the national system of innovation, network of institutions which support economic actors and impinges on the competitive performance of individual firms as well as groups of firms (Kaplinsky and Morris, 2000).

7.2 Summary

The main body of the dissertation is divided into seven chapters which covers introduction, a review of value chain literature, methodological framework and discussion of both qualitative and quantitative results and conclusion. In chapter 1, the background of the research as well as the research objectives, hypothesis and the justification were discussed, while in Chapter 2, a review of the value chain literature, its application in the agricultural sector and the various value chain methodologies were reviewed. Chapter 3 presented a detailed analysis of the study area and the methods applied in the study. Results are presented in three chapters, namely chapter four, that gives a descriptive profile of farmers and identification of their needs and aspiration in agricultural value chains, chapter five that presents a detailed commodity mapping for maize, cabbage and cattle value chains at smallholder level and chapter six, the presents the quantitative

stochastic frontier analysis results. The conclusion and recommendations are presented in chapter seven.

7.2.1 Summary of farmers' needs and aspiration

An extensive survey was carried out in Willowvale communities of the Mbhashe Local municipalities in January 2010. The main aim of the survey was to quantify rural livelihoods of people participating at Ciko and Foundation Community Projects and their respective non-project member villagers in the communities. This involved assessment of the scale of agricultural activities by individual households, definition and explanation of goals of farmers in agricultural activities and an investigation of expressed interest to enter formal and/or informal markets. This comes with a realisation that farmers' needs and aspirations have a greater influence on their participation in both crop and livestock agricultural operations at both production and marketing levels. The study on the farmers' needs and aspirations indicated limited agricultural production where many farmers do not make use of the available rain-fed fields for crop production; hence majority can be classified as subsistence. While modern economies are pushing for maximum participation in agricultural markets; Bromely, (1994), argues that basic structural and technological change is necessary in the subsistence agricultural sector. He further argues that this prior condition is the retention within the subsistence sector of an economic surplus with which to finance the technological change. Bromely (1994), proposed an economic structure that links factor and product markets, whereby subsistence farmers have access to such inputs as credit, machinery, seeds, fertilisers, extension advice and markets for their products. Such a structure must strongly consider the subsistence farmer's hierarchical goals that include subsistence goal (assure survival), safety goal (cautious optimising), surplus goal (to acquire cash for consumption and savings) and the speculative goal for profit maximisation (Bromely, 1994).

7.2.2Value chain mapping summary

In reality, value chains are complex and in most cases the input and output chains comprise more than one channel where these channels can also supply more than one final market. Comprehensive mapping was done to describe interacting and competing channels including those that do not involve smallholder farmers.

The study mapped the value chains for maize, cabbage and cattle enterprises. All value chains under study indicated that they are short and no processing of products is taking place within Mbozi and Ciko Communities. As cabbages and maize move from the farm to retail outlets, value addition start to take place through transportation to the market and processing in supermarkets. In order for small-scale farmers to play a larger role in value chains and benefit from additional markets as well as a part of the returns resulting from value addition, some possible interventions have been identified.

7.2.3 Summary of quantitative results

The specific objective of the section is to assess farm-level technical efficiency indicators and ascertain the determinants of efficiency. The study indicated that efficiency of different enterprises is influenced by a wide array of factors. The efficiency of smallholder cabbage production is influenced by input cost, quantity traded at any given time, rainfall adequacy and the market channel used by the farmer. On the other hand, maize production efficiency depends on area planted, maize price and rainfall adequacy as well. The chapter reveals the significance of rain water in crop enterprises. This characterizes smallholder farming whose reliance on rain fed agriculture cannot be ignored.

Smallholder cattle production is directly influenced by farm labour availability, cattle price, market satisfaction and market channels used by the farmers. The study area is serviced by a perennial river (Shixini River) which caters for livestock water requirements. This explains why water adequacy (enourain) and use of rain water harvesting techniques (rwht) like earth dams are not significant in cattle production. The area is endowed with the major resource (water), but the

potential of the area to increase livestock production lies on land availability and the condition of the veld.

The study also identified the strong influence of market related variables in influencing smallholder agricultural enterprises. The study noted the reliance on informal markets for cabbage, maize and cattle products and formal market participation is very low. Similarly, a study conducted by Makhura, Kirsten and Delgado (2002) highlighted that smallholder maize farming in South Africa is characterised by low levels of market participation. Market stimulation for smallholder farmers can be regarded as a major intervention strategy to boost small-scale farming.

7.2.4 Conclusion and recommendations

Smallholder farmers engage in agriculture for different reasons, ranging from income generation, marketing, household food production, wealth accumulation and cultural reasons. The study of Ciko and Mbozi Communities reveal that villagers' main goal of engaging in agriculture is to produce food for household consumption. Given that less than 6 percent of the respondents indicated marketing as their major goal, this has an implication on the value chains that farmers participate in, as suppliers and not consumers. Support programmes can therefore target to fulfill this objective, but strategies to induce surplus production are required as a way of influencing smallholder farmers' participation in the cash economy.

Government development programs can target to promote cooperation by improving the level of efficiency in the value chain. This is important for buyers seeking to improve quality by establishing closer, more directed relationships with suppliers. The study noted that fresh produce markets are dominated by profit seeking agencies who concentrate on big suppliers and very little or no ties with small suppliers. Such findings demonstrate that unless market signals from established buyers of agriculture produce change, there is limited scope for a development program to facilitate value chain upgrading by smallholder farmers. By understanding incentives and risks at all levels in the value chain, development programs can make the most appropriate decisions for their program interventions.

Whilst results indicated that output prices for cabbages and cattle are critical determinants of production efficiency, it is important to note that agricultural prices alone may not provide sufficient incentive to promote value chain upgrading. Smallholder farmers must also have the capacity (skills and knowledge) to access and adopt improved practices and be able to respond to opportunities to increase their returns. These also need to be supported by increased production. The study showed very low levels of production for cabbage, maize and cattle in terms of area under production and yields per unit area. For instance, the average area under maize in Mbozi and Ciko communities is 0.5ha/household yielding and average of 0.2tonnes/ha. The average area under cabbages is 0.06ha/household (600m^2) with a yield of between 10 and 300heads of cabbages per area. Both crops are grown on homestead gardens, with very minimal irrigation on the cabbage crop. Such low production levels justify the need for high production efficiency to maximise returns per unit area. The underlying assumption is that high production efficiency would lead to surplus output and hence positive ripple effects on the markets.

Value Chain analysis strongly relies on historical or secondary production and marketing data, but due to inadequate record keeping among smallholder farmers in the study area, accurate information was not easily accessible. The recording was not consistent and complete for all enterprises. As such yield and financial figures were in most cases based on what farmers could remember on the date of interviews. This has a strong bearing on decision making and policy since quantities produced per given period, consumption and the respective marketed surplus are all important towards directing farmer support and rural livelihood improvement programmes.

Whilst concrete value chains could have been drawn, lack of important data limited the scope of the study. Accurate data on yield levels for all enterprises was not readily available due to poor record keeping at farm level. The same applies to daily production expenditures, input procurement costs, number of hours worked per enterprise and quantities sold to specific markets. This is actually a learning curve, especially in developing farmer support programmes. Record keeping, agronomic courses and financial management courses strongly need to be incorporated in farmer support programmes.

Market intelligence is another area of concern for smallholder farmers. There is a need to coordinate marketing ventures among farmers and cooperatives located in same area and plan how they can effectively meet consistent supply of the market. Collective marketing could be an

opportunity to be explored. This approach has not been explored in the study area in spite of the close proximity to each other of the two irrigation schemes in the area (Ciko and Foundation Community Projects).

The key to agricultural viability is also infrastructural development. This includes roads, telephone, irrigation as well as grading and storage facilities. These variables cannot be considered in isolation. An improvement in irrigation is expected to boost output, hence a need for storage facilities and efficient road network to the market. Development funds in South Africa have always been channeled towards establishment of irrigation projects but very little has been done to improve marketing of the produce. Currently, Ciko and Mbozi villagers have access to two irrigation projects namely Ciko Santrini and Foundation Community Project. Ciko Project has R240 000 and Foundation Community project has R350 000 in their project accounts. All the funds are made available by the government through department of social development, for input procurement and irrigation development. For both projects, the funds cannot be used to acquire trailers to ferry produce to the market. Such a narrow focus limits the capacity of developing smallholder farmers. The future of smallholder emerging farmers lies in holistic and broad based approaches that rely on complete thinking of the whole cycle of production and marketing.

6.4 Further research

The study is not exhaustive. Further research is required to explore the respective efficiencies of each value chain at processing level. This can be based on cost and resource usage with respect to actual outputs at each stage of the value chain. A thorough institutional analysis is also recommended to find their impact on smallholder market development. The subject of water use efficiency at smallholder level is not complete, hence a need to develop strategies to quantify water usage at each stage of the value chain, in relation to output levels. Lack of irrigation water measurement at smallholder farming level is a challenge that needs to be addressed and scientific methods be devised to overcome the problem.

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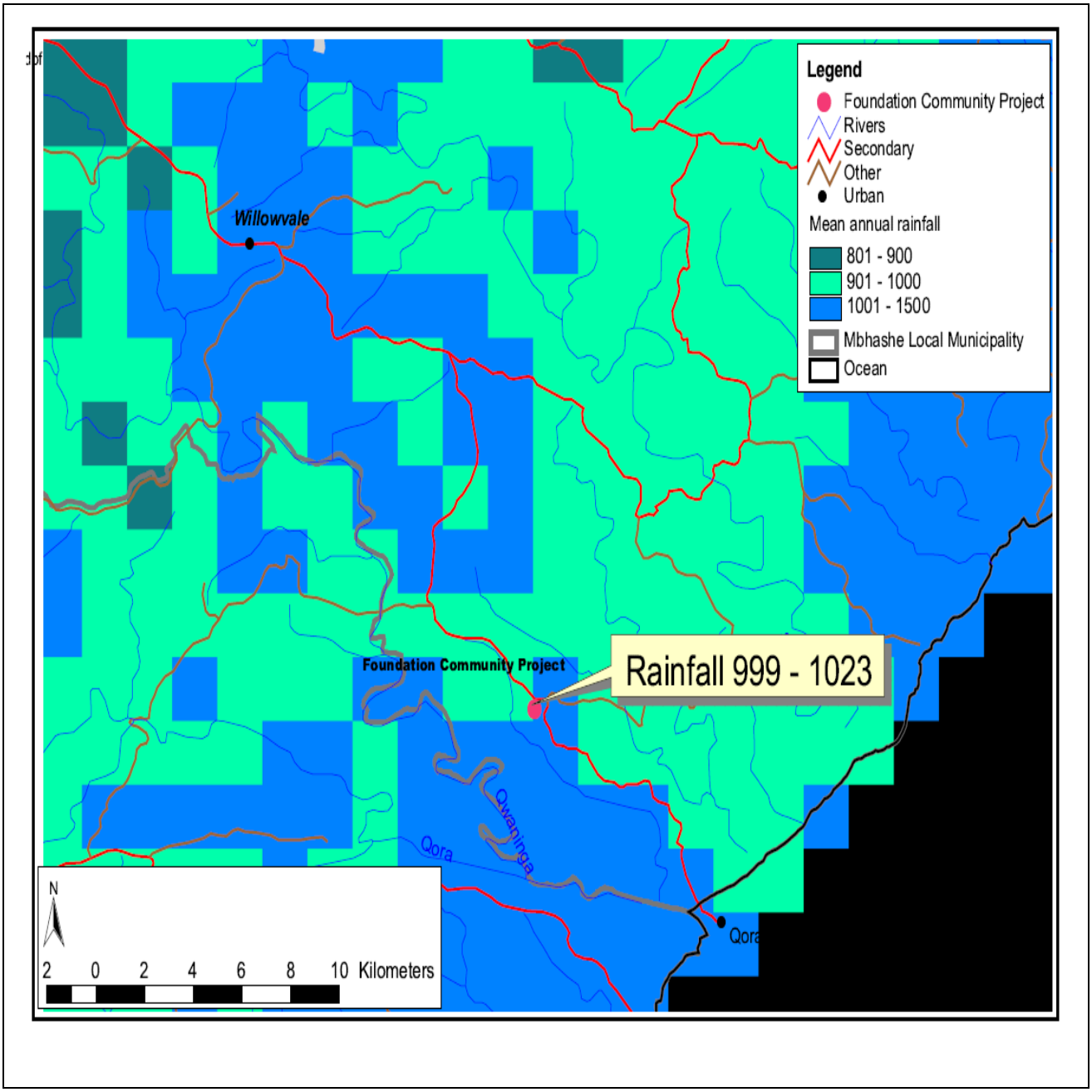
Appendix 1: Agricultural commodity traders in *Willowvale, *Dutywa, *Buterworth and *East London

Name of Business	Ownership	location	Nature of Business	Agriculture Commidities being traded
Ndubs	Private(CC)	Willowvale	Fruit & Vegetable Shop	All product ranges
Kwamadyasi	Family	Willowvale Dutywa Butterworth	Retail	All product ranges
Boxer Super Stores	Private Limited	Dutywa	Retail	All
Foodtown	Family	Dutywa	Retail	All products
Ngumbela			Fruit & Veg Shop	
Spar	Pvt Limited	Dutywa	Retail	All products
Super-Spar	Franchise	Dutywa	Retail	All products
KK Supermarket	Family	Willowvale	Retail	All products
Super-Spar	Franchise	Butterworth	Retail	All products
Willowvale Hotel/Mega Save/Frozen	Family	Willowvale	Retail, Butchery, Hotel	All products
East London Municipality Market	Municipality	East London	Fresh Produce market	All products
Martin & Scheepers	Agency	East London	Market Agency	All products
Border Farmers	Agency	East London	Market Agency	All products
Subtropico	Agency	East London	Market Agency	All products
AA Market Agency	Agency	East london	Market Agency	All products
Georges	Family	Dutywa Butterworth	Fruit & Vegetable Shop	All products
Spargs	Pvt Limited	Butterworth	Supermarket	All products
Emsengeni	Family	Willowvale	Wholesale	All products
Butterworth Fresh Produce Market	Family	Butterworth	Fresh produce market	All products
Fruit and Veg Shop	Family	Willowvale	Fruit & Veg	All products
PicknBuy	Family	Willowvale	Supermarket	All products
Meat Centre	Private	Dutywa	Supermarket	Meat products

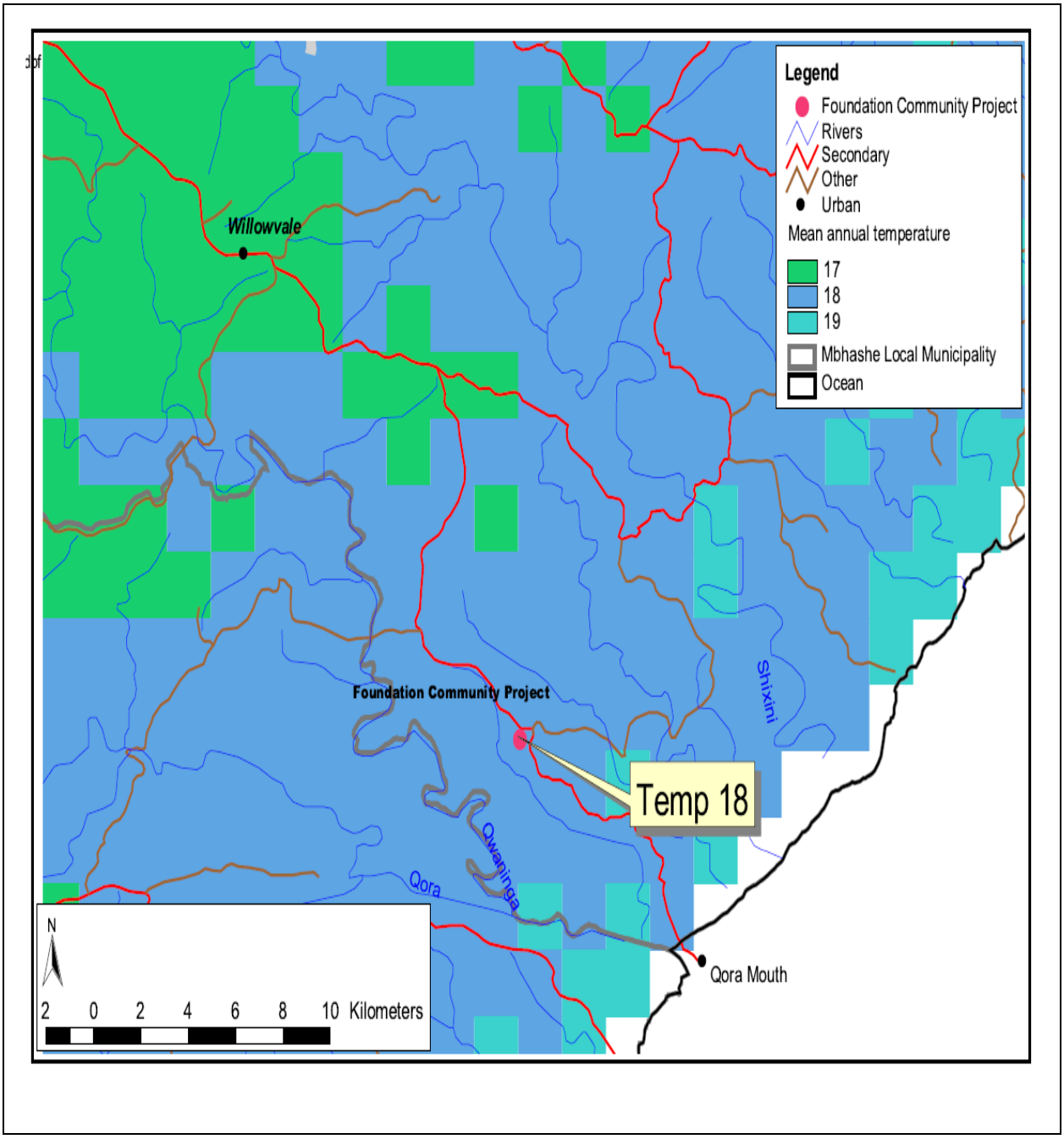
*These are towns that provide market and product to communities within the study area of Foundation and Ciko Community projects.

Appendix 2: Rainfall map for Mbozi and Ciko Villages



Source:Survey data, 2009.
Map produced by the Institute of Natural Resources (INR), KwaZulu Natal,RSA.

Appendix 3: Temperature map for Mbozi and Ciko Villages



Source:Survey data, 2009.
Map produced by the Institute of Natural Resources (INR), KwaZulu Natal, RSA

Appendix 4: Household Questionnaire

UNIVERSITY OF FORT HARE:

HOUSEHOLD QUESTIONAIRE FOR CROP AND LIVESTOCK FARMERS:

*******Research: Smallholder Food value chains in Eastern Cape Province: *********

Interview No..... Interviewer's Name.....

Date.....Village Name: .....……

Local Municipality..... Province.....

HOUSEHOLD INFORMATION

A. Gender of Household head 1: Male 2: Female	**B. Marital Status** 1: Single 2: Married 3: Divorced 4: Widowed 5: N/A (child < 16yrs)	**C. Age (yrs)**	**D. Household Size**	**E. Number of Members who work in the field/ rear livestock (write actual number)**	**G. Level of Education** 1: Primary 2: Secondary 3: Tertiary 4: None 5: Other (Spec)	**H.Employment Status** 1: Employed 2: Not Employed 3: Self Employed 4: Full time farmer 5: Farm Labourer 6: Student 7: Other	**I. What is your source of water for drinking?** 1. Tap 2: Protected well 3: Unprotected well

NB: Household member is considered to be anyone who stays with the family for 3 consecutive months and eats within the same pot with other family members

J. What other training/skills do you have?

.....

.....

K. Indicate the number of household members who fall in the following categories, as an indication of their health status?

L. Fit for agricultural work	M. Chronically sick	N. Too old to work in agriculture (above 65yrs)	O. Too young to work in agriculture (0-12yrs)	P. Staying Out(Away but rely on this household e.g. school children in boarding schools)

Indicate labour usage per operation.

Q. Operation	R. What is the source of labour for these farm operations? 1. Family labour 2. Hired labour 3. N/A	S. Who perform the different farm operations? 1. Men 2. Women 3. Girls 4. Boys 5. Anyone in the family 6. N/A	T. Did any of the members receive training of the operations before? 1.Yes 2. No 3.N/A
Livestock herding			
Livestock Dipping			
Milking			
Other tasks (specify)			
Weeding			
Planting			
Ploughing			
Harvesting			
Irrigation			
Domestic Water provision			
Crop Spraying			

LAND HOLDINGS: (How many plots do you have to access your farming activities (cropping and livestock) within the farm, homestead, dry-land and irrigation scheme and Grazing area?

Indicate the total area for each and the area under operation for each of these plots, and the reasons for under-operation or non-Utilisation)

U. Location	**V. Type of land ownership:** 1: Leasehold 2: Freehold 3: Private 4: Communal 5. Traditional allocation by chief 6. Other (specify)	**W. Total Area (Ha)**	**X. Which of the following best describe your farming Operations** 1: Member of Cooperative/ Association 2: Operate a private company 3 : Operate a registered public company 4: Operate a non-registered individual/family enterprise 5:Other (Specify).....	**Y. Operational Area: (1=0%, 2=25%, 3=50%, 4=75%, 5=100%)**	**Z. State the condition of the field/ garden 1.Fenced 2.Not fenced 3.Partly fenced**	**AA. Reasons for Under-utilisation**
1: Homestead garden						
2: Dry-land						
3: Irrigation						
4:Grazing						

AB. HOUSEHOLD INCOME

AC. **What was your average gross monthly income, last year?** 1: No income 2: R1-R400 3: R401-R800 4:R801-R1600 5: R1601-R3200 6:R3201-R6400 7:R6401-R12800 8:R12801-R25600 9: >R25601	**AD.** **What is/are your Sources of Income?** 1: None 2: Local trader/hawkers buying products from farmers: R**.....** 3: family remittances: R**.....** 4 : Payment for casual labour: R..... 5: Loans from bank: R..... 6: Government Program/Grants: R..... 7 :NGO Donations: R..... 8: Association/ Club/Cooperative: R..... 9 **:** Private firm that buys agricultural products from farmers: R..... 10 : Personal Savings: R..... 11. Local neighbour for produce sold. R…….. 12. Income from spaza shop: R.....	**AE.** **What is your household expenditure patterns per month?** 1: Groceries: R..... 2: Transport: R..... 3: School fees: R..... 4: Input purchase: R..... 5: Clothes: R..... 6. House rental. R..... 7. Maintenance costs, R..... 8. Entertainment, R..... 9. Church contributions, R..... 10. Burial levies, R..... 11. Other (Specify)	**AF.** **Do you use credit to finance household activity ?** **1.Yes** **2.No**	**AG.** **If you used credit what are the sources of the credit (specify, all)**
		Total:	***Total:***	

PHYSICAL HOUSEHOLD/FARM ASSETS

AH. Indicate production Assets you have access to.	**AH.1. Of the accessed assets, indicate actual number used. (use numerical values: 0 = None 0,1, 2, 3, 4, etc**	**AI. Indicate the source of all accessed assets.** 1.Household 2. Borrowed 3. Hired 4.Leased 5. Other	**AJ. If Owned, how were the assets acquired?** 1: Purchased 2: Donated 3: Inherited 4: Other……..	**AK. Year Acquired (Specify e.g. 2002, 2007 etc)**	**AL. Do you consider the production assets to be adequate for Agric Activities** 1: Yes 2: No	**AM. State the value of the household assets using recent prices**
1: Hand Hoes						
2: Shovels						
3: Plough						
4: Harrow						
5: Wheelbarrow						
6: Sledge						
7:Trailer						
8: Scotch cart						
9:Tractor						
10: Vehicle						
11:Homestead/field fence						
12.Draught Animals						

AN. What factors affect your asset ownership?

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AO. What are the reasons for limited access to assets?

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AP. Why are you not using all the available assets?

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RAIN FED CROP FARMING

AQ. Which Crops did you grow last season?	**AR. What season was crop grown** 1: Rainy 2 : Dry 3 :Both	**AS. Area of production (Ha)**	**AT. How much did you harvest?** (write quantity and units eg 20 x 50kg bags)	**AU. How much was sold?** (write quantity and units eg 20 x 50kg bags)	**AV. How much was stored for consumption?** (write quantity and units eg 20 x 50kg bags)	**AW. Do you have enough rain water for your crops?** 1: Yes 2 :No
1: Maize,						
6:Cabbage,						
9:Tomatoes						
10:Carrots						
11:Cucumber						
15.Butternuts						

AX **Do you use any water harvesting /conservation technique?** 1: Yes 2 :No *If yes, answer question "**AX2**" on next page*	**AY.** **What is your major market for your surplus?** 1 :Hawkers 2 :Neighbours 3: Local Shops 4: Fresh produce market 5: Agro-processors 6. Don't sell	**AZ.** **What form do you sell your product? (Indicate for each product)** 1:Unprocessed 2 :Processed 3 Both 4. N/A	**BA.** **What price did you get for each crop Productper unit?** (R/Unit)	**BB.** **Which market looks best for you, for each crop?** (Specify market or put a zero (0) where respondent don't know).

AC. Explain how you conserve or capture water/moisture if any on your farm?.....
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RAINFED CROPS (CONTINUED).

BD. **What is your major reason/goal for crop farming?(Tick)** 1: Marketing 2: Consumption 3:Cultural purposes	**BE.** **Do you aspire to increase your scale of production?(Tick)** **1: No.I'm happy 2: Yes Want Increase**
Explain whether you meet your goals	Explain reason

BF. What are the reasons for you not being able to access any irrigation services from the relevant sources?

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BG. What do you think can be done so that you are able to access irrigation services?

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SECTION : EXTENSIVE LIVESTOCK PRODUCTION

BH. Livestock Type	**BI. Total Number Owned**	**BJ. Source of Livestock** 1:Purchased 2:Donated 3:Inherited 4:Other….	**BK. Do you have adequate water for all livestock categories that you keep?** 1: Yes 2 : No	**BL. What is your water source for each and every livestock?** 1: Dam 2 : River 3 : Tap water 4: Borehole 5: None	**BM. What is your major market for your livestock**? (Specify for each livestock) 1:Neighbours 2: Local Shops/Traders 3: Abattoirs 4: Don't sell 5:Other (specify)	**BN. What form do you sell your product? (Indicate for each product)** 1: Live-Unprocessed animals 2 : Slaughtered/Processed 3: Both
1: Cattle						
2:Sheep						
3 :Goats						
4 :Chickens						
5:Turkeys						

BO. **Are you happy with the market for each livestock/ product?** 1: Yes 2: No	**BP.** **What price did you get for each livestock** **Product** (R/unit)	**BQ.** **Which market do you intend to sell your products if given the chance to do so.** (Specify market or put a zero (0) where respondent don't know).

BR. **What is your major reason/goal for livestock farming?(Tick and specify your major livestock eg cattle, goats, sheep etc)** 1: Marketing 2: Consumption 3:Cultural purposes	**BS.** **Do you aspire to increase your scale of production?(Tick)** **1: No. 2: Yes**
Explain whether you meet your goals …… .....…… …… … **.....** **.....** **.....**	Explain reason ……..... **..** …… ……. **.....** **.....**

BT. What factors negatively affect water usage in the area?

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BU. What can be done to improve access to both agriculture and domestic water in the community? ..... …….
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BV. What factors affect agricultural production in the area(both crop and livestock enterprises)?
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BW. What can be done to improve farmer productivity?
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BX. What factors affect marketing of agricultural products for both crops and livestock?

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BY. What can be done to improve farmer participation in markets?

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BZ. What support (government/private) are you currently getting to improve water availability and usage, for both agriculture and domestic uses?
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