Value chain analysis and resource-use efficiency of small-holder broiler farmers in Capricorn District, Limpopo province

By

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MINI-DISSERTATION

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DECLARATION

I declare that the mini-dissertation hereby submitted to the University of Limpopo for the degree of Master of Science in Agriculture (Agricultural Economics) has not previously been submitted by me for a degree at this or any other university; that it is my own work in design and execution, and that all material contained herein has been duly acknowledged.

Signature, Initials (title) **Date**

Dedication

I dedicate this mini-dissertation to my brother, Shammy Arewanga Luvhengo.

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"God Bless You All"

Luvhengo Usapfa, 2015

Abstract

Food insecurity and hunger problems have received considerable attention in recent years from research experts and governments worldwide. The most important nutrients in food security are proteins, especially animal proteins. Previous studies have indicated that poultry production is the strategic source of animal protein because of its fecundity, fast growth rate and short generation interval. The poultry production sector consists of broiler and layers subsector. In South Africa, broiler production is practised by both large-scale and smallholder farmers; with the former dominating the retail and urban markets. Smallholder broiler farmers on the other hand, produce for local individuals and do not have access to high value chain markets. There are several studies on broiler value chain countrywide and on broiler resource-use efficiency in many developing countries. However, most researchers have not focused on smallholder broiler farmers despite the fact that they provide cheaper broiler meat to the majority of low income rural populations. Thus, this study analysed the broiler value chain and socio-economic factors that contribute to resource-use efficiency of smallholder broiler farmers in general in the Capricorn District of Limpopo Province.

Stochastic Frontier Production Function was used to identify the socio-economic characteristics that contribute to broiler production and to determine the level of resource-use efficiency by smallholder farmers. Value chain analysis (VCA) was used to identify value chain actors and the position of smallholder broiler farmers along the value chain.

Descriptive statistic results revealed that most smallholder broiler farmers are mostly female (79%) and more than 65 % are over the age of 31. The broiler input cost analysis indicated that feed cost contributed the highest expenditure (60%) in smallholder broiler production. Socio-economic factors such as educational level, experience in broiler production, access to credit, gender, access to transport, and age, were significant at different levels and therefore affect broiler production by smallholder farmers. The study also found that farmers in the study area were underutilising their resources with resource-use efficiency varying from 97% to 8%. Several constraints that

prevent smallholder broiler farmers from accessing the high value chain markets were identified.

On the basis of the findings, it is recommended in this study that efforts be made to incentivise younger and energetic farmers to participate in broiler farming, government and the private sector should invest in research in order to establish alternative cheaper feeds to help reduce overall production costs, and the need for improved access to credit in order to enhance the working capital of farmers. Furthermore, the establishment of information sharing marketing cooperatives, slaughtering, processing and packaging facilities for smallholder broiler farmers in the study area will improve access to high value chain markets.

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List of abbreviations and acronyms

AGGP	Agricultural Gross Geographical Product
DAFF	Department of Agriculture, Forestry and Fisheries
FAO	Food and Agriculture Organisation
LDA	Limpopo Department of Agriculture
MLE	Maximum Likelihood Estimates
MSc	Master of Science
MS	Microsoft
SADC	Southern African Development Communities
SMME	Small, Medium and Micro Enterprise
TE	Technical Efficiency
UL	University of Limpopo
VCA	Value Chain Analysis

CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1 Introduction

The problems of food insecurity and hunger continue to attract the attention of research experts and governments worldwide. Several conferences and World Food Summits on human nutrition have brought back to centre stage, the debate on the issue of extreme poverty and hunger, especially in developing African countries (FAO, 2010). The most critical concern in the global food basket crisis is protein, especially of animal origin (FAO, 2004). However, Isika *et al*. (2006) points out that poultry production is a strategic source in addressing animal protein intake shortage in human nutrition because of its potential for high productive capacity (fecundity), fast growth rate, short generation interval and its competence in nutrient transformation to high quality animal protein.

Broiler meat is produced throughout South Africa and there are no known religious, social or cultural inhibitions associated with its consumption (Louw *et al.*, 2011). North West, Western Cape, Mpumalanga and KwaZulu–Natal Provinces have the largest number of broiler meat farmers accounting for approximately 79% of total production while Limpopo Province accounts for only 2% of the country's total broiler production (DAFF, 2011).

Broiler production in South Africa is one of the biggest income earners in the agricultural sector through its exports and local consumption. The total farm income from broiler meat sales for 2010 was estimated to be R22.9 billion; this is because consumers find it as a relatively cheaper supplier of proteins followed by beef, mutton and pork. The broiler sector has been growing in terms of production and sales with an estimated 26% growth registered between 2005 and 2010 (DAFF, 2011).

Many individual smallholder broiler farmers, venture into broiler production mostly for consumption and income generation purposes. This is because the return on broiler investment can be realised earlier compared to other animal production enterprises (Ukwuaba and Inoni, 2012). However, most smallholder broiler farmers cannot fully

participate in high value chain markets due to strict market requirements and higher production inefficiencies compared to large commercial farmers (Baloyi, 2011).

According to FAO (2010), the definition of smallholder broiler farmers varies from one region of the world to another although they have the same intention which is family consumption and sale of surplus. Smallholder farming is also characterised by relatively higher labour to capital ratio compared to commercial farmers. According to Omotosho and Ladele (1998), smallholder poultry farmers mostly practise in their backyard and keep an average flock size of 1000 chickens or less. Most of the broiler chickens produced by smallholder farmers in villages are sold to local customers with lower degrees of processing compared to large commercial farmers who have access to retail and export markets. Regardless of this considerable degree of market segregation, meat from smallholder chicken famers sell at a relatively higher price/kg compared to large commercial farmers, often in the range of 50-100 % higher (Louw *et al.* 2011).

1.2 Research problem

Smallholder broiler farmers in general produce for household consumption and sell the surplus in order to generate income. The two main aims of these farmers are: to reduce food insecurity; and to supplement household income. However, low income levels and poor production resources are the major challenges that affect the growth and development of smallholder broiler farmers in Limpopo Province, especially those located in Capricorn District (Nesamvuni, 2002). Over the years, studies about value chain analysis and poultry production efficiency have been conducted around South Africa (e.g. Louw *et al*., 2011). Unfortunately, most of these studies focused on the poultry industry in general and not on smallholder farmers.

Low productivity of technical farming inputs and other resources in the smallholder agricultural sector is largely due to lack of complementary inputs, inadequately funded extension services, poor distribution of agricultural inputs, inadequate education, lack of credit access and supporting infrastructure. The lack, underutilisation or overutilisation of these resources causes production inefficiencies, lower profits and an increase of food insecurity to smallholder farmers (Belete *et al.,* 1991). This study maps out the

broiler value chain and determines resource-use efficiency of smallholder broiler farmers in Capricorn District. The study further determines the socio-economic factors that contribute to resource-use efficiency of these farmers. An understanding of constraints that restrict smallholder broiler farmers from accessing high value chain markets would provide working tools for policy-makers to design programmes that can contribute to the development of broiler production systems in the study area and South Africa in general.

1.3 Motivation for the study

The findings of the study will provide information on the resource-use efficiency levels of smallholder farmers and the socio-economic factors affecting those levels in Capricorn District. By mapping out the broiler value chain in the district, the study will be able to draw conclusions on how to better link smallholder broiler farmers with other actors along the value chain in order to reduce transaction costs and improve productivity. Information on resource-use efficiency or efficiency within the agricultural sector is necessary given the limited resources available. Similarly, an understanding of broiler farmers' resource-use efficiency levels and factors that contribute to that efficiency (or efficiency) will enable policy-makers to adjust current production and marketing related polices to meet the needs of smallholder broiler farmers. Furthermore, by understanding the limitations of smallholder broiler farmers to participate in high value markets; alternative means could be devised to improve the situation.

1.4 Aim and objectives of the study

1.4.1 Aim of the study

The aim of this study was to analyse the broiler value chain and to identify socio-economic factors that contribute to resource-use efficiency of smallholder broiler farmers in the Capricorn District of Limpopo Province.

1.4.2 Objectives of the study

The objectives of this study were to:

i. Determine the level of resource-use efficiency by smallholder broiler farmers in Capricorn District.

ii. Identify the socio-economic factors that contribute to resource-use efficiency of smallholder broiler farmers in Capricorn District.

iii. Identify broiler value chain actors and their linkage to smallholder broiler farmers in Capricorn District.

iv. Identify constraints that restrict smallholder broiler farmers in Capricorn District from accessing high value chain markets.

1.4.3 Research hypotheses

i. Smallholder broiler farmers in Capricorn District are not utilising their resources efficiently.

ii. Socio-economic factors do not contribute to resource-use efficiency of smallholder broiler farmers in Capricorn District.

iii. Actors along the broiler value chain are not linked to smallholder broiler farmers in Capricorn District.

iv. There are no constraints that restrict smallholder broiler farmers in Capricorn District from accessing high value chain markets.

1.4.4 Research questions

i. What is the level of resource-use efficiency of smallholder broiler farmers in Capricorn District?

ii. What are the socio-economic factors that contribute to resource-use efficiency of smallholder broiler farmers in Capricorn District?

iii. Who are broiler value chain actors and how do they link with smallholder broiler farmers in Capricorn District?

iv. What are the constraints that restrict smallholder broiler farmers in Capricorn District from accessing high value chain markets?

1.5 Organisational structure of the study

Given that the aim of the study was to analyse the broiler value chain and to determine socio-economic factors that contribute to resource-use efficiency of smallholder broiler farmers in Capricorn District of Limpopo Province; the study is structured as follows: chapter two presents the literature review; chapter three discusses the methodology, including methods of data collection and analytical techniques used to analyse the data; chapter four presents the results of the empirical analysis; chapter five summarises the findings and provides conclusion, policy and research recommendations. A list of references and appendices are provided.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Poultry consumption is considered the main source of animal protein worldwide. In South Africa, poultry is one of the fastest growing agricultural subsectors in terms of production. The poultry industry is composed of two enterprises, layers and broilers. The latter provides meat that is preferred by almost all cultures, it is affordable and of good quality, while the former provides eggs and meat as a secondary product (Louw *et al,* 2011). This chapter examines literature related to the study, the background on South African broiler industry, broiler industry value chain in the country, smallholder famers and agricultural markets in Limpopo Province, economic efficiency, and reviews previous studies on resource-use efficiency and some socio-economic factors that contribute to resource-use efficiency.

2.2 *South African broiler industry*

Poultry production, especially broiler meat production is the largest segment of South African agriculture. It contributed 17.5% of the total agricultural production in 2010 and 35% of all animal products in the same year. The overall income from broiler meat sales (local and exports) was estimated at R22, 940 billion/year in 2010. Broiler production dominates the agricultural sector and is popular among low income earners, especially in rural areas where it is perceived as a relatively cheaper source of protein (DAFF, 2011).

Broiler meat is produced throughout South Africa with North West, Western Cape, Mpumalanga and KwaZulu-Natal Provinces having the greatest number of farmers accounting for approximately 79% of the total production. The number of birds slaughtered increased significantly to about 49% in 2010. This was mainly driven by the increasing demand of white meat (DAFF, 2010). The increase in demand for white meat is mainly due to shifts in consumer preference and the perception that it is healthier than red meat and also because of overall population growth (Harry *et al.*, 2000).

In Limpopo Province, commercial broiler meat farmers are estimated at 404 (199 farmers and 205 contract growers). This is less than the number of smallholder broiler farmers estimated at about 1 554 in the province. Large-scale and smallholder farmers produced an estimated total of 920 million chickens in 2010, and employed about 60 000 workers in the same year. The broiler industry in Limpopo Province is also considered as one of the major employers in the agricultural sector, approximately 10% of all agricultural sector workers in Limpopo are employed in the broiler industry and more than 60% are engaged in smallholder broiler farming either as owners or employees (DAFF, 2011).

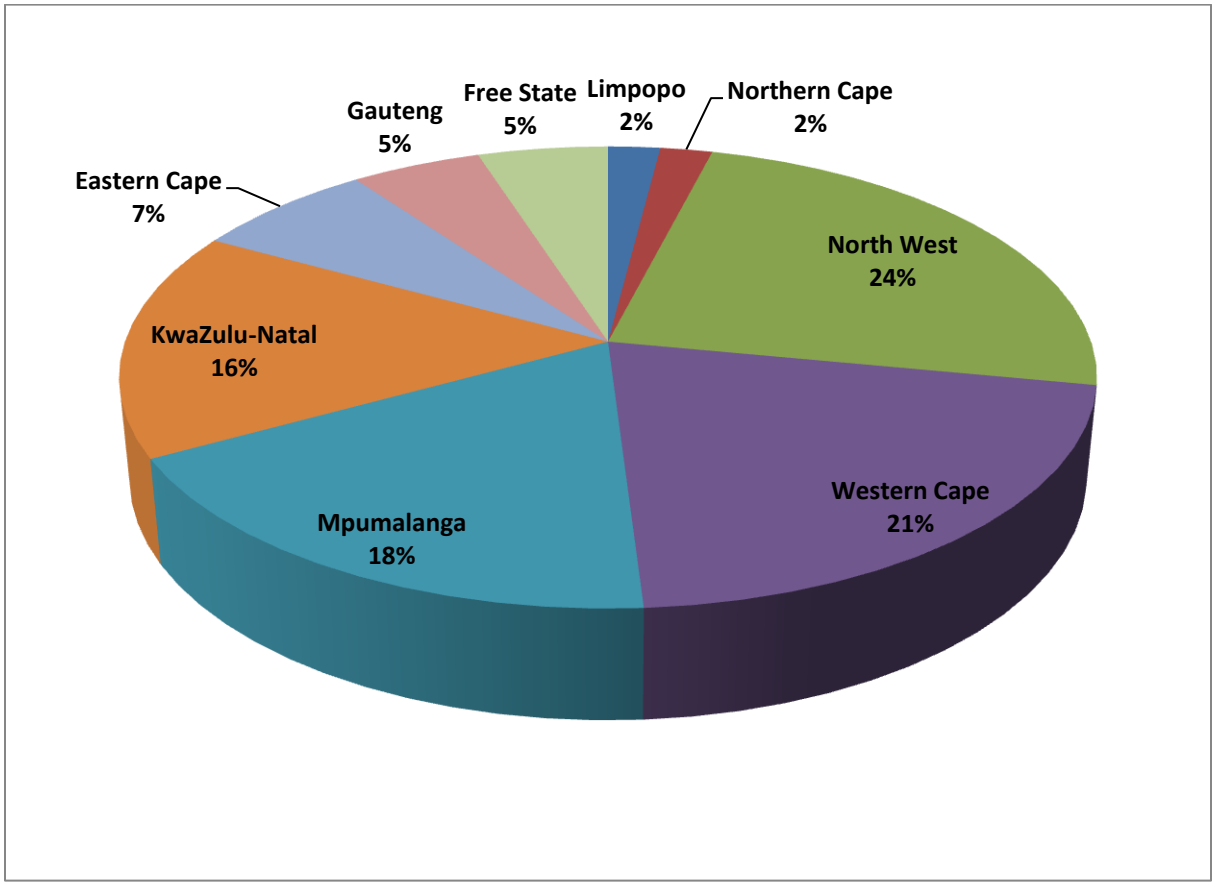


Figure 1.1: Distribution of broilers production by province in South Africa 2009/10.

Source: DAFF, (2011:4)

2.3 Broiler value chain structure in South Africa

The South African broiler meat value chain consists of primary and secondary subsectors. Broiler meat farms, contract growers, feed companies, other input suppliers and breeders form part of the primary sector of the value chain. In the secondary sector, there are abattoirs, importers, exporters and retailers. There are about 48.6 million broiler consumers in the country. Production in kilograms is around 1 349 million, domestic consumption around 1 551 million and export 18.7 million in 2010 (DAFF, 2011).

The South African broiler meat primary subsector is dominated by 2 large farmers, namely, Rainbow and Astral. These two companies combined, produce 50% of the total broiler meat production in the country. The other 4 medium-sized farmers (Tydstroom, Daybreak, Chubby Chick and Rocklands) combined, have a 15% market share. Argyle owns 2% of the market with more than 300 000 broilers produced per week (DAFF, 2011). These commercial broiler firms are characterised by high levels of integration and lower production costs per unit. Lower production costs give large commercial farmers added competitive advantage over smallholder farmers (Humphrey and Schmitz, 2002).

In 2010, the secondary and processing subsector consisted of approximately 265 formal registered abattoirs in South Africa. These abattoirs sell broiler chickens mainly to five main retailers such as Pick n Pay, Shoprite-Checkers, Spar and Woolworths. These retailers buy the largest share of domestic broiler production from commercial and SMME farmers and no significant record from smallholder broiler farmers (DAFF, 2011). According to Harry *et al.* (2000), the absence of smallholder participation in the retail market is due to strict market standards that smallholders farmers have to adhere to, lack of smallholder broiler products standardisation and supply consistency, infrastructure and information flow by smallholder broiler farmers.

Through the export of broiler meat to other countries, especially SADC countries, the broiler meat industry is also an earner of foreign exchange. DAFF (2011) shows that 92 % of exported meat is from reliable and consistent commercial farmers while about

8% is from SMME exporters, there are no records of smallholder broiler farmers' exports up to date. According to Baloyi (2010) and Harry *et al.* (2000), the lack of smallholder exports in the sector is also due to strict production, packaging and volume exports standards that smallholder farmers have to adhere to. This leaves the export market to be tendered to large commercial broiler farmers who can efficiently adhere to regulatory export standards.

Broiler meat exports are mainly from the Western Cape, Eastern Cape, Free State and Gauteng provinces. Limpopo province experienced fractional exports of broiler meat from 2001 to 2010. Out of the exports recorded from Limpopo province, they were all from large commercial and well integrated farmers such as Rainbow located in four main districts, namely Mopani, Vhembe, Capricorn and Waterberg (DAFF, 2011).

2.4 Agricultural value chain and smallholder farmers in Limpopo province

Smallholder agricultural sector is important to the economic growth of Limpopo province because it provides employment and income to thousands of smallholder farmers, hawkers and street vendors. In Limpopo province, all five districts in the province contribute to agricultural economy by supplying agricultural products of different nature. Most of the agricultural commodities in the province are produced by smallholder farmers and few large commercial farmers. A number of smallholder farmers market their produce to informal markets whereas large commercial farmers market their produce to formal markets through contracts (Baloyi, 2010). Even so, Limpopo province still has a high agricultural potential in terms of producing high value agricultural products for the export market through smallholder farming (Oni *et al.*, 2004). However, the participation of smallholder farmers in high value chain markets is very low due to high market standards that they cannot abide to, leading to exclusion from supplying their products to high value markets. The exclusion of smallholder farmers leads to reduced production, profitability and growth of smallholder farming (Baloyi, 2010).

Countrywide, smallholder farmers are excluded from the value chain because of the efficiency advantage of large farmers and strict market entry regulations (Humphrey and Schmitz, 2002). Few smallholder farmers who manage to gain access to value chain

find themselves in a learning space from the large commercial farmers dominating the retail market who are already characterised by low production cost, better access to value chain information and well integrated along the value chain (Baloyi, 2010). According to Magingxa and Kamara (2003), if the value chain approach is not adopted in smallholder agriculture, the invisible hand type of coordination such as opportunistic behaviour will dominate traditional markets and smallholder farmers will lose more because advantage will be taken off by value chain players who have enough value chain information and lower transaction costs. The value chain analysis approach can help smallholder farmers to better access and secure markets and enter into formal market contracts, have better access to information and minimise transaction costs.

Smallholder farmers in the Limpopo province face constraints such as lack of access to agricultural support services, distance from the market, lack of capital and infrastructure. Even though some smallholder farmers are given financial and technical support by government, integrating smallholder farmers into the higher value chain market will still remain a challenge, unless major investments from both public and private stakeholders are made towards on-farm and off-farm infrastructure and the improvement of information access by smallholder farmers will help reduce transaction costs (Nesamvuni, 2002 and Baloyi. 2010). Humphrey and Schmitz (2002) outlined that for these farmers to participate successfully in the value chain, they should try to work collectively as co-operatives or any form of alliance. This collective behaviour will help smallholder farmers to collectively bargain market conditions when dealing with either suppliers or customers.

2.6 Production theory and farm efficiency

Production is the transformation of inputs such as capital, labour and land into output in the form of goods and services with the main objectives being profit maximisation, output maximisation, utility maximisation, cost minimisation or even a combination of all of the above. During the production process, most farmers are concerned with efficiency in the utilisation of inputs to achieve either economic or technical efficiency. Economic efficiency is a combination of technical and allocative efficiency. It aims at maximising the profits of farmers while at the same time minimising production costs. According to

Nicholson (1978), technical efficiency underlines the same concept as Pareto efficiency. An allocation of resources is Pareto efficient if no one individual (or activity) can be made better off without making someone else (or another activity) worse-off (Hardwick *et al.*, 1988).

With regard to farm production, the annual general increase in productivity does not imply that the increase is a result of technical or allocative efficiency improvements alone, but may have been also due to technical changes or the exploitation of economies of scale from some combination of production factors (Kumbhakar and Lovell, 2000).

2.7 Factors used for broiler production

The number of day old chicks is considered the main input in broiler production. The quantity required is also known to be associated with the scale of production and the housing size. It is important for broiler farmers to determine the optimum number of chicks per house in order to reduce mortality and ensure resource-use efficiency (Ugwumba and Lamidi, 2011).

Broiler farming is known to be one of the riskiest industries in livestock production due to vulnerability to diseases, change of seasons and high feed costs. It is noted that the amount of labour in man days as one of the resources employed in broiler determines the production efficiency, however, this also depends on the scale of production (Ng'eno *et al*, 2010). Feed costs were found to account for more than 50% of overall broiler production costs, making it one of the most significant inputs in broiler production (Ng'eno *et al*., 2010 and Louw *et al*., 2011).

The size of the broiler house also contributes in production efficiency through stock density. The optimum growth space/bird which also helps to reduce mortality in broiler production is 4.5 m^2 / bird. More or less than the specified occupation may result in reduction in growth rate and overcrowded houses and this may cause stress and increase in mortality rate due to stress and heat, hence production inefficiency (Ugwumba and Lamidi, 2011).

According to Harry *et al.* (2000), poor protection from adverse climatic conditions in Limpopo province increases the exposure of disease outbreaks. Disease outbreak results in losses of up to 70% of the chickens at 12 weeks of age during winter in Limpopo province. The optimum use of vaccine and medication is one of the key factors in broiler production.

2.8 Socio-economic factors that contribute to broiler production efficiency

Experience in production and educational level of smallholder farmers have been known to positively contribute to resource-use efficiency in North African countries. Experience is associated with learning by doing which in the long run, reduces the cost per unit of the total production, thus improving resource-use efficiency. It is stated that the longer a farmer engages in broiler production activities, the better he or she will be in production (Ugwumba and Lamidi, 2011). Educational level is measured by the qualification (primary, secondary or tertiary) that a particular farmer has obtained. According to Ogolla and Mugabe (1996), the educational level of farmers improves resource-use efficiency because when farmers are educated, they might know how to optimally use-resources.

Access to credit from formal and informal institutions is one of the important factors for agricultural productivity. According Heidhues and Buchenrieder (2004), many poor rural farmers heavily rely on informal credit institutions in order to cope with food insecurity and its effects as well as finance the purchase of farm inputs.

Government provides support to smallholder farmers through extension offices which are under the provincial Department of Agriculture. These extension officers provide both smallholder and large commercial farmers with business planning, input, production and marketing information (Baloyi, 2010). This information helps smallholder farmers to better utilise resources and optimise output levels.

2.9 Review of previous studies on value chain analysis and resource-use efficiency in the poultry industry

2.9.1 Broiler industry supply chain study with emphasis on feed and feed-related issues

The two main objectives of this study were to identify the various stakeholders and role players in the broiler subsector and feed industry (including their structure, size and market share) in South Africa. The second objective of this study was to identify the factors that restrict and/or enhance competitiveness and profitability within the feed production supply chain. The supply chain analysis conducted for this study revealed the role played by the feed industry in broiler production. Feed costs account for more than 70 % of the total costs of broiler production. The findings exposed structural shifts in the feed industry, indicating that the impact of these costs structure on growers was extreme, especially where feed manufacturers were part of a holding company chain. Restrictive factors currently experienced by broiler industry players in doing business, among others, include issues relating to infrastructure for feed manufacturers (the cost and competitiveness of doing business). A good infrastructure may assist with optimising the feed industry at higher levels of operation (Louw *et al.*, 2011).

2.9.2 Resource-use efficiency in poultry production in Bureti District, Kenya

The objective of the study was to determine resource-use efficiency, optimal production levels and production techniques of small-holder poultry farmers in Bureti District, Kenya. Primary data was obtained using a set of structured questionnaires from 300 farmers drawn from the study area using simple random sampling techniques. The data was analysed using Cobb-Douglas production function. The findings of the study revealed that some resources used in poultry production were underutilised while others were over utilised. The efficiency indicators for poultry feeds (0.0603) showed that poultry feeds were inefficiently used. Labour efficiency indicator (-0.091) showed that farmers were not only grossly inefficient in the use of the resource but also over utilised it while the efficiency indicator (60.86) for poultry equipment implied the resource was inefficiently utilised (Ng'eno *at al.*, 2010).

2.10 Chapter summary

Access to higher value chain and resource-use efficiency remains a major challenge faced by smallholder farmers. This chapter has examined the background on poultry production and consumption in South Africa; factors that contribute to broiler production were defined and explained. Previous studies related to resource-use efficiency and value chain analyses were also reviewed. The next chapter presents the methodology used in the study.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology used in the study. It starts by giving a description of the study area, maps of Limpopo Province and Capricorn District municipality, data collection procedures and data analysis. The chapter also describes the data collection methods and the analytical framework outlining stochastic frontier production and value chain analysis.

3.2 Description of the study area

Limpopo province covers a surface area of about 12.46 million hectares with an estimated population of 5.404 million inhabitants (StatsSA, 2012). It is divided into five districts as shown in Figure 3.1 below; Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg. There are five climatic regions identified in the province: the Lowveld (arid and semi-arid) regions, middleveld, Highveld, semi-arid region and the escarpment region having sub-humid climate with an average rainfall of 700mm per annum. These different climatic regions explain why the province produces a variety of agricultural produce ranging from tropical fruits (banana and mangoes), to cereals (maize and wheat), and vegetables such as tomatoes, onion and potatoes (Mmbengeni and Mokoka, 2002). Limpopo province is characterised by a dual agricultural system consisting of about 5000 large scale commercial farmers who occupy 70 % of the arable land and 273000 small-scale farmers occupying the remaining 30 % of the agricultural land. Most of the small-scale farmers are in the deep rural areas and the majority are women who produce food crops and livestock for family subsistence and sell the surplus to supplement income (Meliko *et al.*, 2010).

Figure 3.1: Map of Limpopo province, South Africa
Source: Morula pictures, Limpopo provincial government, 2007

This study was conducted in Capricorn District situated at the centre of Limpopo Province. The District is at the core of the province's economic development and hosts the capital of the province, Polokwane. Capricorn is sub-divided into 5 district municipalities namely; Polokwane, Lepele-Nkumpi, Blouberg, Agang and Molemole and has an estimated total population of 1.26 million (StatsSA, 2012). According to Oni *et al.,* (2004), when assessing the Agricultural Gross Geographical Product (AGGP) of Limpopo province, Capricorn District ranked forth, contributing about 15 % to the total AGGP. Figure 3.2 below shows the five municipalities in Capricorn District.

Figure 3.2: Map of Capricorn District municipality, Limpopo province
Source: Morula pictures, Limpopo provincial government, 2007

3.3 Data collection

Primary, cross sectional data was used in this study. The target population in this study consisted of all individual smallholder broiler farmers within Capricorn District. Capricorn District was chosen against other district municipalities because according to LDA (2012), the district contributed only 12% to the agricultural gross geographical product (AGGP) list, and has the highest broiler production growth potential. The selection of 61 smallholder broiler farmers within the study area was done using disproportionate stratified random sampling procedure with gender as the strata. This sampling procedure was used to ensure that both male and female farmers were equally represented even though they are not proportional in size. The list of smallholder broiler farmers was obtained from the Capricorn District Department of Agriculture. It is estimated that there are 330 individual smallholder broiler farmers in Capricorn District municipality (LDA, 2012). Selected smallholder broiler farmers were interviewed using a

structured questionnaire that sought information on demographics, production and marketing methods, cost and sales structure.

3.4 Data analysis

The Stochastic Frontier Production Function was used to identify the socio-economic characteristics that contribute to resource-use efficiency of smallholder broiler farmers in the study. A value chain analysis diagram was used to identify value chain actors and how they are linked to smallholder broiler farmers.

3.4.1 Stochastic frontier production function

The Stochastic Frontier production function model has been in operation since its introduction by Aigner *et al.* (1977). Battese and Coelli (1995) extended the model, suggesting that the technical efficiency effects could be further expressed as a linear function of explanatory variables, reflecting farm specific characteristics. The model is able to represent the relationship of an output to input as this gives an indication to the level of resource-use efficiency. This model also decomposes the error term into a two-sided random error that captures the random effects outside the control of the farm operations and the one-sided efficiency component.

The model is able to estimate the individual technical efficiency of the respondent smallholder broiler farmers as well as determinants of technical efficiency at the same time by assuming the presence of technical efficiency of production. The range of TE is 0 to 1. TE = 1 implies that the farm is producing on its production frontier and is said to be technically efficient (Battese and Coelli, 1995). In this study, technical efficiency is an estimate of resource-use efficiency by smallholder broiler farmers. The Stochastic Production Model can be written as:

$$Y = f(X_a ; B_i)\, e^{E}$$

Whereby:

Y = Quantity of broilers produced

X_a = A vector of input and other explanatory variable quantities

B_i = A vector of unknown parameter to be estimated

e = Error term

E = Stochastic disturbance term consisting of two independent elements which are U_i and V_i, where by $E = U_i + V_i$

U_i = One-sided efficiency component with a half normal distribution.

V_i = Are the nonnegative unobservable random variables associated with the technical efficiency of broiler production.

The random error E represents random variations in the economic environment facing the production units, reflecting change such as weather, disease outbreak and variable input quality; measurement errors; and omitted variables from the functional form (Aigner *et al*. 1977). Then the frontier of the farm is given by:

$$Y = f(X_a B_i) + E$$

Efficiency measures for each farm can be calculated as:

$$U_i = f(Z_b ; \delta_l)$$

Whereby:

Z_b = Vector of farm specific factors, and

δ_i = Vector of parameters

Both parameters of stochastic frontier and the efficiency effects model can be consistently estimated by maximum likelihood procedures. Microsoft excel software was used to log all input data before creating a data file for the programme to use. STATA 10 was used to analyse the data and to find the coefficients of unknown parameters by maximum likelihood estimation. The function is summarised as follows:

$$\ell nY = B_0 + B_1 \ell n X_1 + B_2 \ell n X_2 + B_3 \ell n X_3 + B_4 \ell n X_4 + B_5 \ell n X_5 + (U_i + V_i)$$

Whereby:

Y = Number of chickens produced (Number of chickens/ year).

X_1 = Quantity of day old chicks (Number chicks purchased/ year).

X_2 = Amount of labour employed for production (Man hours/ year)

X_3 = Cost of vaccines, drugs and chemicals (Rands/ year)

X_4 = Quantity of feeds. (Kilograms)/ year)

X_5 = Total area of broiler housing (m^2)

B_i = Coefficients of unknown parameters to be estimated

It is also assumed that the efficiency effects are independently distributed and E arises by truncation at zero of the normal distribution with mean variance, whereby:

$$U_i = \delta_0 + \delta_1 \ell n Z_1 + \delta_2 \ell n Z_2 + \delta_3 \ell n Z_3 + \delta_4 \ell n Z_4 + \delta_5 \ell n Z_5 + \delta_6 \ell n Z_6 + \delta_7 \ell n Z_7 + \delta_8 \ell n Z_8$$

Where by:

Z_1 = Access to extension support (1- Has access to extension support; 0 -Otherwise)

Z_2 = Educational status (1 - Formal education and 0 – Informal education)

Z_3 = Experience in broiler production (Number of years in broiler farming)

Z_4 = Access to credit (1 - If the farmer has access to credit; 0 - Otherwise)

Z_5 = Gender (1 - If the farmer is male; 0 - Female farmer)

Z_6 = Access to own transport (1- Has access to transport; 0 - Otherwise)

Z_7 = Hired labour (1 - If farmer hires labour; 0 - Otherwise)

Z_8 = Age of farmer (Number of years)

δ_i = Coefficients of unknown parameters to be estimated

ℓn = Natural logarithm.

3.4.2 Value chain analysis

Value chains can be mapped and analysed using value chain analysis (VCA) and could include qualitative and/or quantitative tools. In this study, the third and fourth objectives were addressed using the qualitative approach to draw up the value chain (input to marketing) map and also to identify constraints that restrict smallholder broiler farmers from accessing high value chain (Hellin and Madelon, 2006).

3.5 Chapter summary

This chapter has outlined the econometric and qualitative framework that make it possible to analyse the broiler value chain and to determine socio-economic factors that contribute to resource-use efficiency of smallholder broiler farmers in Capricorn District of Limpopo Province. The stochastic production frontier has addressed the first and second objectives whereas value chain analysis has addressed the third and fourth objectives. All results of the analyses are presented in the next chapter.

3.6 Limitations of the study

The fact that some smallholder broiler farmers are not registered with the provincial department of agriculture nor have a cooperative organisation represented a sampling limitation. To overcome this limitation, LDA extension officers from the service centres had to point out the direction of smallholder broiler farmers. Cost and production quantity records were not readily available from some of the interviewees. Quantity and

prices of inputs had to be estimated using current retail information from nearby input stores.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results and findings of the study. The objectives of the study were: to analyse the smallholder broiler value chain, identify socio-economic factors that contribute to resource-use efficiency, identify broiler value chain actors and their linkage to smallholder broiler farmers as well as the constraints that restrict smallholder broiler farmers in Capricorn District from accessing high value chain markets. The chapter starts by presenting a summary of the socio-economic characteristics of smallholder broiler farmers, results of the stochastic frontier production function, smallholder broiler value chain and the marketing constraints faced by these farmers.

4.2 Background and socio-economic characteristics of farmers

Socio-economic variables of broiler farmers in Capricorn District which could be relevant in influencing output are examined and presented in Table 4.1 below. The results indicate that most farmers (93.4 %) are older than 40 years, with ages ranging between 41 - 50 and 51 and above. Only 6.5 % are below 30. Seventy nine percent of farmers were female. This finding contradicts the results of recent studies on broiler production (Ugwumba and Lamidi, 2011; Ukwuaba and Inoni, 2012) which reported male dominance in smallholder poultry production in North African countries. In summary, this finding reveals that smallholder broiler production in the study area is dominated by older female farmers and there is low participation of young male farmers. Some female farmers in the study indicated that they were unhappy with domestic responsibilities thus the reason to venture into broiler production full time. According to Echebiri *et al.* (2006), famers who participate full time are likely to make efficient use of production resources because they are paying full attention to the business.

The majority of respondents (66%) are married and they also indicated that broiler production is a supplementary source of income in order to support their dependents. Also, the majority of farmers (91.8 %) in the study have acquired different levels of

literacy through primary, secondary or tertiary qualifications. According to Ogolla and Mugabe (1996), these smallholder farmers are expected to have a higher level of resource-use efficiency than 8.2 % of the farmers who do not have any form of educational qualification.

Approximately 64 % of the farmers keep a flock size of 500 to 1000, thirty six percent keep less than 500. The average stock size of these farmers is 706 broilers/ year. In terms of quantity, according to the study by Omotosho and Ladele (1998), backyard poultry farms of 1000 birds/year and below are regarded as small-scale production. This implies that the participants were all smallholder farmers.

About 90% of the smallholder broiler farmers practise broiler production full time while 10% indicated that they only farm broilers part time. More than 90 % of the farmers indicated that they neither have access to credit nor receive any form of government support in terms of financial assistance. Farmers who had credit access indicated that they acquired credit from informal sources.

Table 4.1: Socio-economic characteristics of small-holder broiler farmers

	FREQUENCY	PERCENTAGE (%)
Age		
>30	4	6.5
31-50	40	65.5
51<	17	27.9
Total	***61***	***100***
Gender		
Male	13	21
Female	48	79
Total	***61***	***100***
Marital status		
Single	21	34
Married	40	66
Total	***61***	***100***
Edu-background		
Formal education	56	91.8
No formal education	5	8.2
Total	***61***	***100***
Level of involvement		
Full time	55	90
Part time	6	10
Total	***61***	***100***
Flock size kept		
100-500	22	36
501-1000	39	64
Total	***61***	***100***
Access to credit		
No Access	58	95
Access	3	5
Total	***61***	***100***
Government Support		
No Support	55	90
Support	6	10
Total	***61***	***100***

Source: Computed by author from survey data (2013)

4.3 Stochastic frontier production function results

The Maximum Likelihood Estimates (MLE) of the stochastic frontier production parameters of the five factors affecting broiler production were: No of day old chicks, labour, cost of medication, feed cost and area of broiler house for smallholder broiler production. The results are presented in Table 4.2.

Number of day old chicks - The estimate of number of day old chicks is positive and significant at 1%.The coefficient of number of chicks is 0.197581 implying that a 1% increase in the number of day old chicks will result in a 19% increase in the number of broilers produced per cycle given that other inputs are constant. This finding is consistent with the findings by Ng'eno *at al*. (2010) and Ukwuaba and Inoni (2012).

Labour - The estimate of amount of labour employed in broiler production in man hours is significant at 1% and positive. The 0.76 elasticity coefficient of labour indicates that a 1% increase in the number of man hours employed will result in a 0.76 increase in the number of broilers produced given that other inputs are constant. This result is in agreement with the results by Ng'eno *at al*. (2010) and Ukwuaba and Inoni (2012), which both concluded that the significance of labour is due to the fact that smallholder broiler farming is labour-intensive.

Cost of medication - The amount spent on medication is positively related to the number of broiler chickens produced and the estimate is significant at 1%. The coefficient of this estimate is 0.145, implying that a 1% increase in the expenditure on medication will result in an increase in the number of broilers produced. Echebiri *et al*. (2006) also supports this finding, and argues that medication is important in broiler production since broiler chickens are more vulnerable to diseases compared to traditional free-ranging chickens.

Feed cost - The coefficient of feed quantity is positive and significant at 1%. One percent increase in quantity of feed supplied to broilers will result in 0.187 increase in the quantity of broilers produced given that other inputs are constant. This finding is consistent with the finding by Ng'eno *at al*. (2010).

Area of broiler house - The broiler housing coefficient is negatively related to broiler output and is significant at 1%. This implies that an increase in space of a broiler house per number of broilers will reduce broiler production and this finding contradicts the findings by Ng'eno *at al.* (2010) and Ukwuaba and Inoni (2012). The findings from the two authors indicated that floor space is positively related to number of broilers produced. Some of the smallholder broiler farmers indicated that this behaviour mostly

occurs in winter when it is cold. If there is more space among broilers, broilers tend to lose weight and are also susceptible to flu.

Table 4.2: Estimated stochastic frontier production function for smallholder broiler farmers

Variable	Parameters	Coefficient	Standard Error	Sig Level
Intercept	β_0	0.240	0.006	***
No of chicks	β_1	0.197	0.036	***
Labour	β_2	0.762	0.280	***
Cost of Meds	β_3	0.145	0.042	***
Feeds	β_4	0.572	0.085	***
Area of house	β_5	-0.276	0.070	***
Diagnostic statistics				
Sigma	σ^2	0.4221812	0.0764453	
	σ_v	4.67 e -07	0.0000427	
	σ_u	0.64976	0.0588263	
Lambda	λ	0.9999	0.0588262	
Log Likelihood		-17.97237		

*** Significant at 1%

Source: Computed by author from survey data (2013)

4.3.1 Hypotheses testing and model fitness

The presence or absence of technical efficiency in the study was tested using the important parameter of log likelihood in the half normal model function σ^2. If $\sigma^2 = 0$, there were no effects of technical efficiency and all deviations from the frontier function were due to noise (Aigner *et al.* 1977). From the table above, the estimated value of $\sigma^2 = 0.422$ which significantly differs from zero.

The estimated lambda (λ) parameter is high and estimated to be 0.9999.According to Aigner *et al.* (1977), this can be interpreted to mean that the differences between actual (observed) and frontier output are dominated by technical efficiency. The results suggest that about 99.99% of the variation in broiler output among smallholder farmers in Capricorn District is due to other socio-economic factors and the differences in their technical inefficiencies. Based on this finding, the first null hypothesis which states that socio-economic factors do not contribute to resource-use efficiency of smallholder broiler farmers in Capricorn District was rejected.

4.3.2 Return to scale

The return to scale was found by adding all the values of betas (β). The sum of β's was less than one, indicating decreasing return to scale. This meant that smallholder broiler farmers in the Capricorn District were overutilization their resources. Therefore, this finding fails to reject the second null hypothesis which states that smallholder broiler farmers in Capricorn District are not utilising their resources efficiently. These findings contradict with Ng'eno *at al*. (2010), Ukwuaba and Inoni (2012) and Echebiri *et al*, (2006). In their respective studies, it was also found that poultry farmers in North African countries operated at increasing returns to scale, indicating that the farmers invested fewer inputs in their production. For farmers to achieve an optimum level of resource-use efficiency, they will have to increase the amount of input used to a point where the marginal value product is equivalent to the marginal cost of that particular input. By utilising resources optimally, farmers in this study will realise an increase in productivity and hence profitability.

4.3.3 Sources of technical efficiency in broiler production

The determinants of technical efficiency in smallholder broiler production are presented in Table 4.3. The result of the analysis revealed that educational level, experience in broiler production, access to credit, gender, access to transport and age were statistically significant at varied risk levels.

Table 4.3: Sources of technical efficiency in broiler production

Variables	Parameters	Coefficient	Standard Errors	T-Ratio	Sig Level
Government support	δ_1	0.009	0.115	0.08	NS
Educational level	δ_2	0.548	0.138	3.97	***
Experience in broiler production	δ_3	0.326	0.114	2.86	***
Access to credit	δ_4	-0.515	0.204	-2.52	**
Gender	δ_5	-0.807	0.215	-3.74	***
Access to transport	δ_6	-0.854	0.199	-4.27	***
Hired labour	δ_7	0.681	0.173	0.39	NS
Age	δ_8	-0.741	0.237	-3.12	***

*** Significant at 1%; ** Significant at 5% and NS – Not Significant

Source: Computed by author from survey data (2013)

Government support - The coefficient of government support through extension services in the efficiency model was found to be insignificant but positive. This implies that government support positively affect technical efficiency of smallholder farmers in the study area. However, the fact those individual broiler farmers are not in constant contact with extension advisors resulted to the insignificance of this variable. Some farmers indicated that extension advisors focus more on large broiler projects rather than on individual farmers. According to Baloyi (2010), extension service provides

smallholder farmers with information and introduces them to technologies that may improve resource-use efficiency.

Educational level – The coefficient of educational level is significant at 1% and positive and this indicates that educational levels of broiler farmers positively contribute to technical efficiency of smallholder broiler farmers in the study area. Farmers who have formal education are likely to apply their educational capacity in using resources efficiently compared to farmers with no formal education. This could be because broiler production requires farming experience through learning by doing and specific knowledge in broiler production and marketing education rather than general education. This result corresponds with the findings by Ogolla and Mugabe (1996) and Ezeh *et al.* (2012). Their findings reveal that farmers who are more educated may be more efficient in utilising resources because they can easily adopt and know how to use new technology.

Experience in broiler production – The coefficient of experience in broiler production is significant at 1% and positive. This indicates that experience in broiler production positively contributes to technical efficiency in the study area. According to Ugwumba and Lamidi (2011), experience in broiler production is associated with learning by doing which in the long run, reduces the cost per unit of the total production, thus improving resource-use efficiency.

Access to credit – The coefficient of access to credit is negative and significant at 1% indicating that lack of access to credit by smallholder broiler farmers negatively affects technical efficiency by smallholder farmers in the study area. This result corresponds with the findings by Ezeh *et al.* (2012). Their findings also revealed that access to credit contributes to efficiency by broiler farmers. They argue that access and availability to cheaper credit can improve farmers' liquidity and enable them to afford technical inputs like better housing facilities, medication and feeds.

Gender - The coefficient of gender was found to be negative and significant. This indicates that female farmers, who represented 79% of respondents, were more involved in broiler production compared to male farmers are less technical efficient

compared to male farmers. This is due to the fact that most females are more involved in domestic activities and spend more time at home than males.

Access to transport – This coefficient is negative and significant at 1 %. This indicates that lack of access to own transport negatively contributes to resource-use efficiency by smallholder broiler farmers under the study area. This is due to the fact that most smallholder farmers are located in far-flung rural areas away from input suppliers and collective markets. This makes access to transport a very significant input to access inputs and transport broilers to the market. Sixty-six percent of farmers also indicated that public transport is not very convenient and is expensive while 26 % of farmers indicated that hired transport increases their production cost.

Hired labour - The coefficient of hired labour is positive but not significant at 1, 5 and 10 %. Most farmers indicated that they do not prefer to hire labour because it comes at an extra cost. This result also agrees with the findings by Omonona *et al.* (2010) who indicate that due to lower production scale, the productivity of hired labour is insignificant and does not contribute to technical efficiency by smallholder farmers.

Age – This coefficient is negative and significant at 1%, indicating that the age of smallholder broiler farmers contributes to resource-use efficiency in the study area. Farmers who are older are more inefficient in broiler production. This is due to the fact that they are less energetic compared to younger farmers since broiler production requires constant attention. This finding is consistent with the results by Ezeh *et al.* (2012) whose results indicate that increasing age would lead to decrease in technical efficiency in smallholder farming. However, this result also disagrees with findings by Echebiri *et al.* (2006). Their findings showed age to be positively related to resource-use efficiency. They also argue that older farmers are more efficient with resource utilisation because they have acquired experience through learning by doing.

4.3.4 Distribution of technical efficiency in poultry broiler production

The results of the frequency distribution of technical efficiency of smallholder broiler farmers are presented in Table 4.4 below. The estimated technical efficiency varied with minimum and maximum values of 8 % and 97 % respectively with an average of 75 %.

It indicated that the average farmer in the study area could save 22.6 % [i.e. 1-(75/97)] of costs and the most technical efficient could realise a 91.75 % cost saving [i.e., 1-(8/97)] compared with the technical efficient level of the most efficient farmer.

Table 4.4: Distribution of technical efficiency in broiler production

Technical efficiency (%)	Range	Frequency (%)
0-20	8	13.11
21- 40	0	0
41- 60	0	0
61- 80	1	1.63
81-100	52	85.24
Total	61	100
Maximum technical efficiency 97 %		
Minimum technical efficiency 8 %		
Mean technical efficiency 75 %		

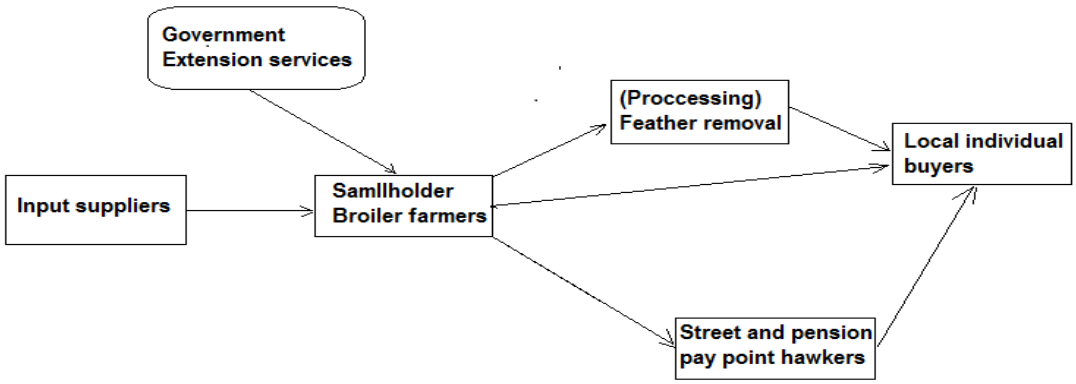
Source: Computed by author from survey data (2013)

4.4 Smallholder broiler value chain

Figure 4.1 below shows the flow of activities and linkages among different actors within the smallholder broiler value chain. Based on this finding, the third null hypothesis: Actors along the broiler value chain are not linked to smallholder broiler farmers in Capricorn District is rejected. Smallholder farmers indicated that they individually acquire inputs such as day old chicks, medication and feed from their nearest input markets. According to Baloyi (2010), smallholder farmers do not have bargaining power because they buy their inputs individually from the input supplier and this reduces their bargaining power and makes them vulnerable to price variations. Farmers also indicated that inputs are either delivered by the suppliers or farmers collect the inputs themselves. Some smallholder farmers indicated that they have to travel a distance of more than 10km to the closest input market.

Even though most of them (90%) indicated that they do not receive government support, some farmers mentioned that they receive government support through

agricultural technical support. Smallholder broiler farmers in the study indicated that they sell their produce (broilers) at pension pay points and informally from their homes to individuals and local consumers. However, the distance between the farms and the pay points constitutes one of the limitations. Moreover, broilers are transported to distant markets using own or hired transport. There are traders who sometimes collect broilers from farmers, process (feather removal) and sell to individual consumers.



Source: Computed from survey data (2013)

Figure 4.1: Smallholder broiler value chain in Limpopo province

4.5 Smallholder broiler production system

4.5.1 Production inputs

Besides other supporting inputs, participants indicated that four most basic and important inputs in smallholding broiler production are day-old chicks, water, medication and feed. The participants further indicated that they are not concerned with the breed of day-old chicks but medication and feed.

There are four main types of medications used by farmers in the study area: Stress pack, Lasota, Gumboro and Virukill. Stress pack is given to day old chicks upon arrival to the farm. The purpose of this medication is to help chicks combat leg weaknesses and help them adjust to the new environment, especially after long delivery trips. However, other farmers stated that they use brown sugar mixed with warm water

instead of stress pack. Lasota strain is given to chicks one day after arrival. It is a vaccine against new castle disease. Gumboro vaccine is also used for vaccination against flu and other breathing-related infections. Other farmers also pointed out that they use Virukill as a disinfectant in order to avoid cross infections.

The three types of feed used by broiler farmers are starter pallets, grower and finisher. They are used for different purposes as follows: Starter pallets are given to chickens less than 2 weeks, grower feed is given to chickens between 2 to 5 weeks. Only 85 % of farmers agreed that they use finisher feed which is given to broilers 6 weeks before their sale. Some farmers (42%) indicated that they use their own transport to collect feed from retailers. Fifty eight percent of farmers rely on hired transport. Most farmers within Capricorn District indicated that they purchase their feed in Polokwane (e.g. Engel fish). Basically, farmers indicated that they do not have any problems with input suppliers. However, the farmers indicated that high transport cost and high chick mortality rate upon arrival remain the main problems.

Table 4.5: Medication and feed types used in smallholder broiler production

INPUT TYPE	NAME	PURPOSE
Medication	**Stress pack**	**To prevent weak leg and reduce stress**
	Lasota	**To prevent new castle disease**
	Gumboro	**Vaccination against flu and other breathing infections**
	Virukill	**Disinfectant, to avoid cross infections**
Feeds	**Starter Pallets**	**To supply chicks with necessary nutrients during the first two weeks**
	Grower	**Provide enough nutrients for growth between 2 to 5 weeks**
	Finisher	**To maintain the weight of broilers after 6 weeks.**

Source: Computed by author from survey data (2013)

4.5.2 Smallholder broiler input costs

The expenditure composition in smallholding broiler production among farmers in Limpopo province is presented in Figure 4.3 below. Feed cost constituted 60% of the total expenditure which is more than day old chicks, medication, maintenance, hired labour, permanent labour and electricity combined. This implies that feed cost is an important factor in broiler production. These findings agree with the findings of Ng'eno *et al.* (2010) and Louw *et al.* (2011). In their studies, they reported feed cost to be above 50% of the variable production cost.

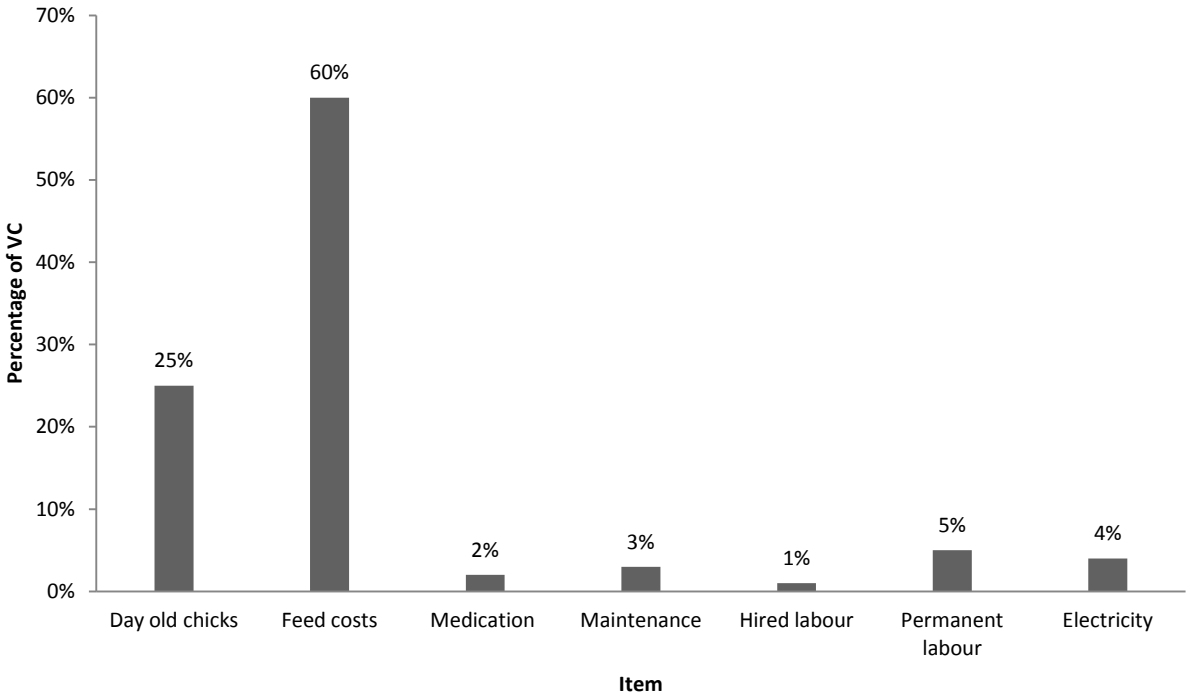


Figure 4.2: Input cost contribution to variable cost

4.5.3 Production infrastructure and methods

Figure 4.3 below shows the broiler housing conditions of smallholder broiler farmers within the study area. Forty four percent of the farmers indicated that they do not have heating but lighting in their housing facilities. Thirty seven percent indicated that they only have heating without lighting in their facility whereas, only 19 % have both lighting and heating. Most of the farmers also indicated that the trade-off between lighting and heating is because they are saving on electricity. According to Ng'eno *at al*. (2010),

housing structure contributes to broiler productivity since most of the broiler species are weather sensitive. In winter, broiler houses with heating and lighting are more productive than those without heating and lighting. Most smallholder broiler farmers interviewed during the study indicated that their productivity might increase if housing facilities and heating equipment could be improved.

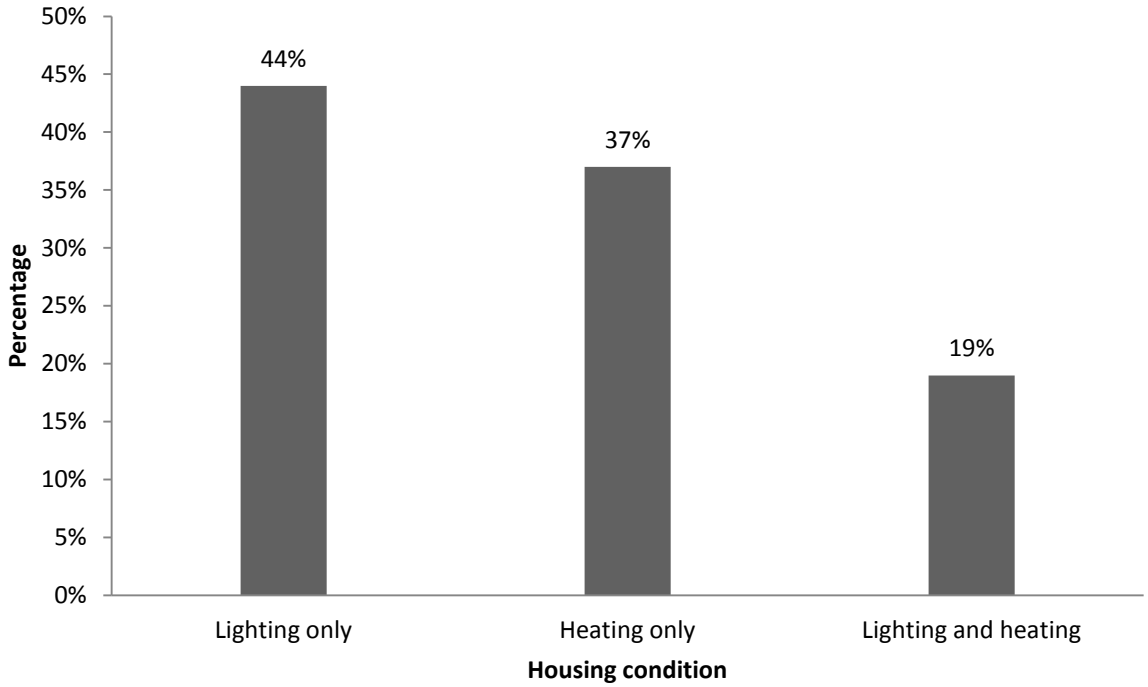


Figure 4.3: Housing infrastructure condition, lighting and heating

4.6 Access to support services

4.6.1 Access to credit

Access to cheaper credit by smallholder broiler farmers may improve access to inputs hence productivity. This makes credit access to be one of the important factors in smallholder broiler production. Most famers (99%) indicated that they do not have access to formal credit due to lack of collateral repayment capacity required by financial institutions. However, some farmers who have access to informal credit indicated that they acquired credit from loan shacks, (*Mashonisa)*, since their conditions are not as strict as those of formal institutions. Loan sharks charge interests of more than 40 % on

capital borrowed, this reduces the amount of profit to be reinvested in broiler production and thus lowers the potential for expansion by smallholder farmers. According to Manganhele (2010), access to cheaper credit can help smallholder famers expand their operations and also use their resources efficiently. Access to credit positively contributes to productivity and income levels of smallholder famers. However, more than 90% of smallholder farmers in developing countries are denied access to access by formal institutions due to lack of security (collateral) and low repayment capacity.

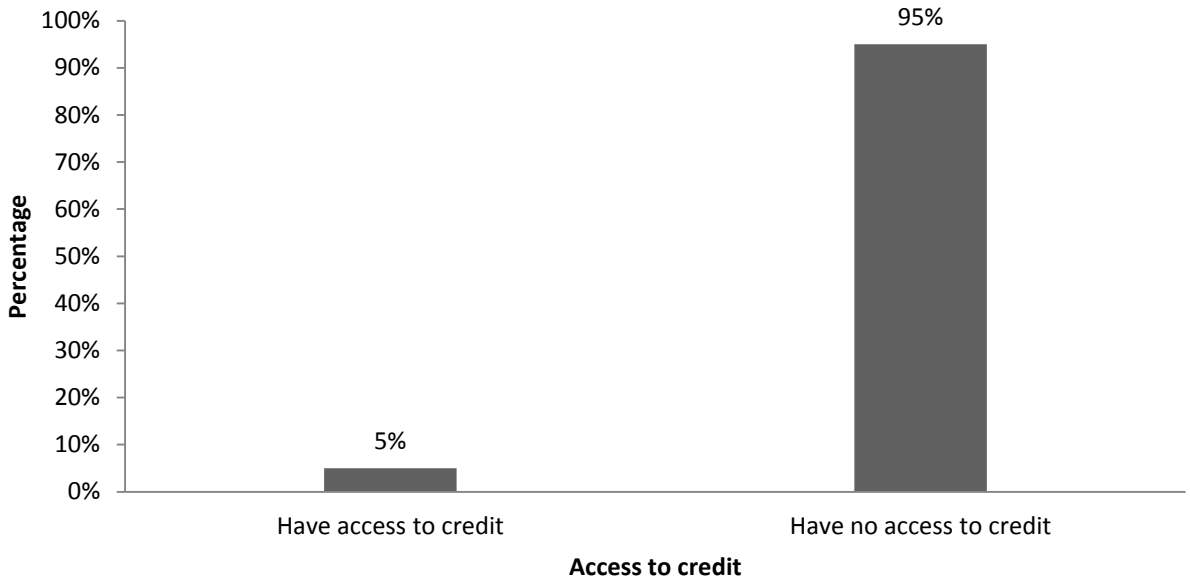


Figure 4.4: Access to credit

4.6.2 Access to extension support

The Limpopo Department of Agriculture has adopted the municipality focused approach to service delivery whereby extension officers are based across different municipalities and service centres. This means that extension advisors are closer to the farmers, reducing the travel cost that farmers had to incur before this approach was introduced (Meliko *et al*, 2010). In this study, most smallholder farmers interviewed complained about inadequate government support and limited extension visits. Ten percent of farmers stipulated that they have never received technical advice from their extension officers, even though most of them reside within a radius of 10 km. Those who received extension support pointed out that they were dissatisfied with the services provided by

the extension officers. In some cases, farmers indicated that the visits by officers were just routine checks and lacked direction and not very specific. Baloyi (2010) reports that most extension service workers have an attitude towards farmers and “think they know what farmers want without asking the farmers themselves”. This attitude is not helping smallholder farmers as they are not involved in the planning and in decision-making

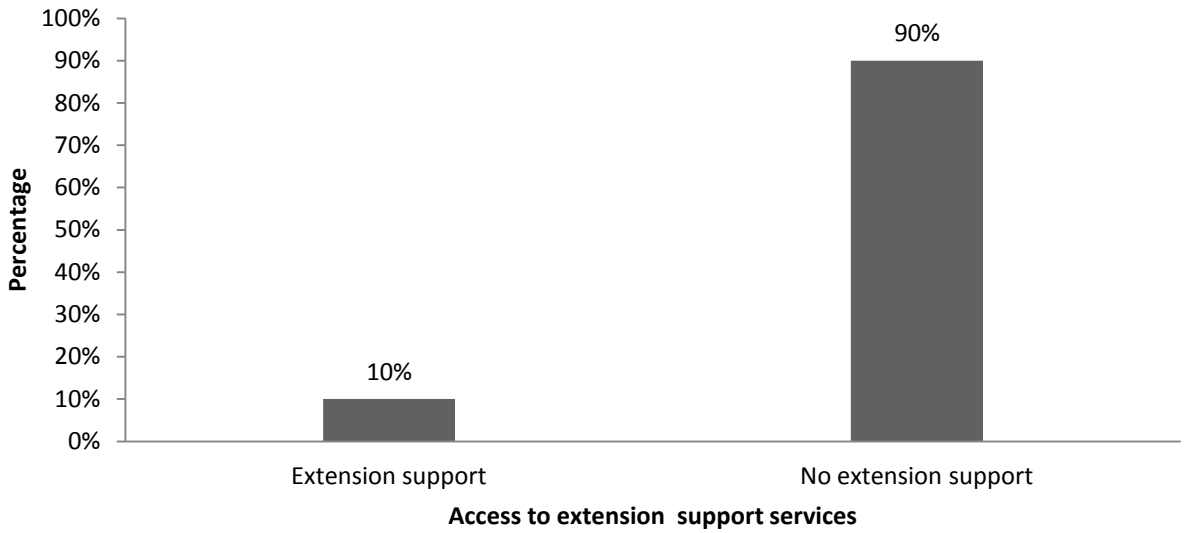


Figure 4.5: Access to extension support

Interviewees receiving extension support (10%) in the study pointed out that support from extension officers may take different forms. The type of extension support received by smallholder farmers include: compiling business plans, input supply and technical advice. None of the extension support received by smallholder broiler farmers was in the form of financial assistance, building and equipment and market related assistance. Some smallholder broiler farmers who received assistance indicated that it was beneficial to their business, but mentioned that they would prefer to receive more extension support as there are still a few elements lacking in the functioning of their business.

4.6.3 Access to transport and distance from the market

Access to transport plays a significant role in farmers’ ability to acquire inputs and access markets. The high cost of hiring and lack of transport have negative impacts on

these farmers in terms of accessing distant markets, with higher prices and more consumers such as pension pay points, social functions, government departments and other high value markets. Instead, these farmers resort to selling to individual customers at farm gate prices. From Figure 4.4 below, 42 % of individual broiler farmers indicated that they have their own transport. Some smallholder broiler farmers indicated that they hire transport to acquire inputs and deliver their produce to the market. However, most smallholder farmers indicated that it is not cost-efficient for them to hire transport as it is expensive. According to Louw *et al.* (2011), lack of access to transport for smallholder farmers leads to loss of quality of produce, late delivery and consequently, lower prices. Some farmers indicated that lack of transport leads to late delivery to the market and overutilisation of resources (feed and other inputs), reducing profit margins.

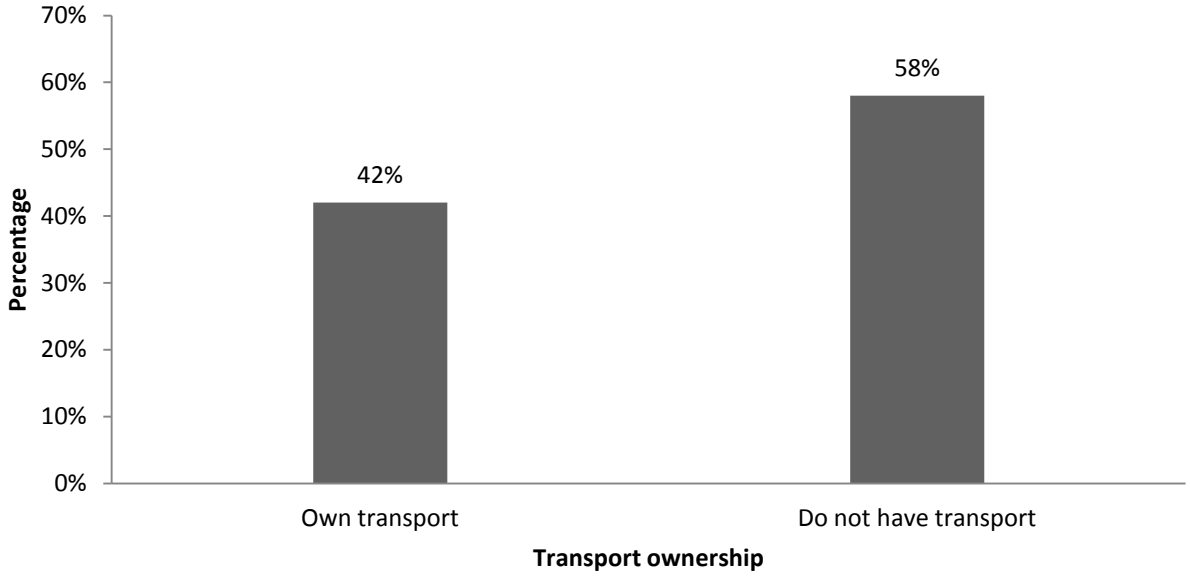


Figure 4.6: Share of access to transport by smallholder broiler farmers

4.7 Marketing constraints faced by smallholder broiler farmers

All farmers interviewed in the study indicated that there are several marketing constraints that restrict them from accessing higher value chain. Therefore, the fourth null hypothesis: There are no constraints that restrict smallholder broiler farmers in Capricorn District from accessing high value chain market is rejected based on this finding. Some of the constraints that restrict smallholder broiler farmers from accessing

the higher value chain are summarised in Figure 4.7 below. Distance from the market, low production quantities and lack of knowledge and information are the most dominant constraints.

Most farmers showed strong concerns over distance from the market and high transport cost being two of the most significant restrictions to access higher value chain markets. They indicated that lack of reliable transport leads to supply inconsistencies, whereas higher transport costs lead to higher broiler prices.

Insufficient production quantities and lack of financial resources were also mentioned as some of the constraints to access to markets. This indicates an inability by smallholder broiler farmers to meet the needs of larger retailers. Thirteen percent of farmers indicated that with proper financial assistance, they could expand their scale of production and be able to meet high demands at cheaper prices.

Only 16% of respondents indicated a desire to obtain contracts to work with larger farmers or retail markets. However, they were unable to meet the requirements of the retail market and food production standards. This is because broilers in smallholder production systems are often susceptible to poor production standards, diseases and high mortality rates. Some farmers indicated that they do not have information on retail market requirements, inputs standards and regulations.

One of the finding of this study was that there are few extension advisors who provide support to individual smallholder farmers in the form of technical advice and input support. This makes it difficult for farmers to have access to production information that might help improve production efficiency and standards. Twenty percent of farmers indicated that they did not have enough information on how to access high value chain markets. They also indicated that they do not know private establishments that assist smallholder broiler farmers with research, production, processing or marketing information.

One of the main restrictions mentioned by smallholder broiler farmers in the study area is lack of processing and packaging facilities (abattoirs and storage). All smallholder farmers interviewed in the study indicated that they do not have access to an abattoir.

Access to processing and packaging facilities adds value to the broiler value chain. This may help smallholder farmers to better access retail markets. Some farmers indicated that they manually slaughter chickens and remove the feathers for customers as per request and charge a processing fee of R5 to R9 per bird.

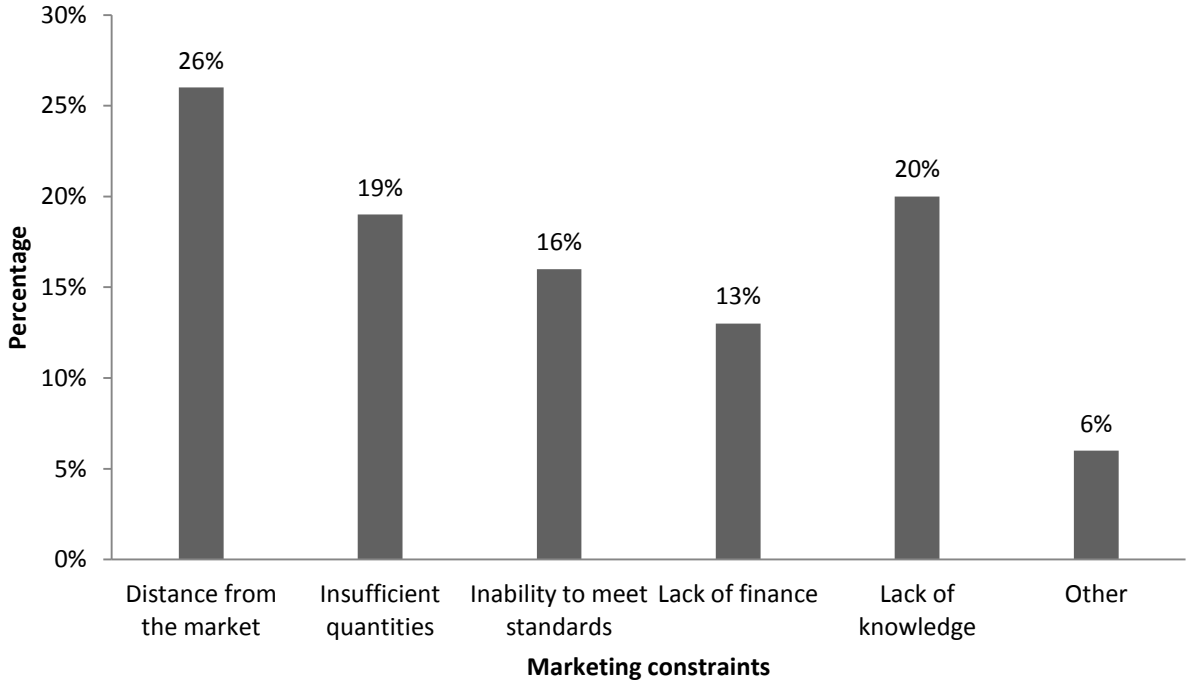


Figure 4.7: Marketing constraints faced by smallholder broiler farmers

4.8 Smallholder broiler market opportunities

All smallholder broiler farmers interviewed in the study were located in rural areas with few supermarkets and restaurants. They indicated that broiler production has an opportunity to expand and penetrate the high value chain market if provided with adequate assistance from government and other value chain actors. Baloyi (2010) also indicates in his findings that smallholder farmers have an opportunity to fill in the market gap in rural areas where they are located, since they provide cheaper products to low income earners. However, accessing higher value chain markets will require an efficient coordination and support among private and public stakeholders in uplifting smallholder agriculture.

4.9 Chapter summary

This chapter has presented a general overview of the socio-economic characteristics of small-holder broiler farmers and their level of resource-use efficiency. The linkage among different actors along the smallholder broiler value chain of smallholder farmers within Capricorn District was also examined. The production and marketing constraints faced by smallholder farmers in accessing high value chain markets were also identified. The next chapter summarises, concludes and outlines policy and further study recommendations based on the findings of the study.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter summarises the main findings of the study and concludes on the basis of the findings derived from the empirical results. It also provides recommendations on how smallholder broiler farmers can utilise their resources efficiently and overcome constraints that prevent them from entering high value chain markets. The chapter is presented into four sections as follows: Section 5.1 is the introduction; section 5.2 presents the summary of the study, section 5.3 the conclusions, section 5.4 gives policy recommendations while section 5.5 provides recommendations for further studies.

5.2 Summary

The aim of the study was to analyse the broiler value chain and to determine socio-economic factors that contribute to resource-use efficiency of smallholder broiler farmers in the Capricorn District of Limpopo province. The four objectives of the study were to: Identify the socio-economic factors that contribute to resource-use efficiency, determine the level of resource-use efficiency, identify broiler value chain actors and their linkage and identify constraints that restrict smallholder broiler farmers in Capricorn District from accessing high value chain markets.

To address the four objectives of the study, the researcher used two analytical techniques; the Stochastic Frontier Production Model and Value chain analysis. Socio-economic characteristics were analysed using descriptive statistics. Results of the socio-economic characteristics of farmers indicate that majority (79%) of smallholder broiler farmers are females aged above 31 years. Most respondents had formal education in the form of primary, secondary and tertiary qualification and were married.

Results from the Stochastic Frontier Production Function indicate that some production resources used by farmers are: number of day old chicks, cost of medication and vaccine, feed, labour and floor space and were all found to be significant at 1%. All these production resources showed a positive contribution towards level of broiler

output apart from medication cost which had a negative contribution. Socio-economic variables (educational level, experience in broiler production, access to credit, gender, access to transport and age) were significant at different risk levels, while government support and hired labour were non-significant. Although some variables were not significant, they still contributed to the production efficiency of smallholder broiler farmers.

With regard to factors that contribute to efficiency, government support, cooperative membership and hired labour were not significant. However, educational level, experience in broiler production, gender and access to transport were all significant at 1% and access to credit was significant at 5%. The average technical efficiency of farmers in the study area was 75 % with the minimum and maximum being 8% and 97% respectively. These findings suggest that opportunities still exist to increase productivity and incomes of smallholder broiler farmers in the study area. Productivity can be achieved by increasing the efficiency of resources used at the farm level by up to 25% on average.

Smallholder farmers sell broilers at collective markets in local towns and from their homes to local consumers. Chickens are transported to markets using own or hired transport. Traders sometimes collect and manually process (feather removal) broilers from smallholder broiler farmers and transport them using small trucks to distant markets like pension pay points and collective markets.

Several constraints faced by farmers towards accessing high value chain markets were identified such as product standard requirements, insufficient quantities, lack of processing and packaging facilities, lack of transport, lack of finance and lower government support that will allow them purchase required inputs and educate them on better production methods, lack of proper housing infrastructure and absence of smallholder broiler farmers' organisation.

5.3 Conclusions

Four research hypotheses were stated in this study. The first one stated that smallholder broiler farmers within the study are not utilising their resources efficiently.

This hypothesis was rejected because the results have concluded that smallholder broiler farmers in Capricorn District are underutilising their resources.

The second hypothesis stated that socio-economic factors do not contribute to resource-use efficiency of smallholder broiler farmers in Capricorn District. Results of this study do not support this hypothesis because there were identified socio-economic factors (educational level, experience in broiler production, access to credit, gender, access to transport and age) that significantly contributed to resource-use efficiency by smallholder farmers in Capricorn District.

The third hypothesis stated that actors along the broiler value chain are not linked to smallholder farmers. However, the findings of this study do not agree with the hypothesis because there are actors along the value chain that are linked to smallholder broiler farmers. The smallholder broiler chain is simple and involves few actors, with few interactions made directly between producer and consumer through live-bird markets. Processing in the smallholder chain is minimal is through manual slaughter and feather removal. Smallholder broiler farmers in the study area focus on selling live birds and processed broilers to individual consumers and collective markets.

The fourth hypothesis stated that there are no constraints that restrict smallholder broiler farmers in Capricorn District from accessing high value chain markets. However, the findings of this study do not support this hypothesis since there were identified constraints that prevent smallholder broiler farmers from accessing high value chain markets in the study area.

In general, it could be concluded in the study that smallholder broiler farmers in the study area are not using their resources efficiently. It was also found that smallholder broiler farmers are linked to other actors along the value chain and they have the potential to access high value chain markets if they could overcome some market constraints they are currently facing. Efficient input, production and marketing support system might also assist farmers to utilise their resources efficiently and help them to better access higher value chains.

5.4 Policy recommendations

Based on the findings of this study, extension officers should be motivated to frequently visit smallholder farmers and introduce new packages on modern technologies and information that promote productivity and resource-use efficiency of broiler farmers.

The study also recommends an awareness campaign in order to explain the contribution of smallholder farmers on job creation and food insecurity reduction. This will go a long way in helping other private actors such as input suppliers along the value chain on how to better link and share information with these farmers.

Investments in research and development that will focus on the establishment of cheaper feed and medication that could help reduce production cost for these smallholder broiler farmers and improve resource-use efficiency.

Stakeholders like processing and logistics companies (abattoirs) could provide possessing, packaging and product transportation to famers in the study area and will help reduce market constraints.

Marketing cooperatives could help smallholder broiler farmers in the study area to share production, processing, packaging and marketing information that will help access higher value chain markets.

The study recommends the support of smallholder broiler framers through production and marketing intervention techniques by government and other value chain actors. This is because smallholder broiler farming has proven to be beneficial to both farmers and low income consumers, through the provision of extra income and reduction in food insecurity.

5.5 Recommendations for further studies

The aim of the study was to analyse the broiler value chain and to determine socio-economic factors that contribute to resource-use efficiency of smallholder broiler farmers in the Capricorn District of Limpopo province. Since there are no studies that have been conducted on Limpopo province, the ultimate goal was to contribute to the

knowledge base concerning how farmers can improve the efficiency of production and gain access to high value chain markets. Most broiler farming studies in the country have focused on a specific actor of the whole broiler value chain and not smallholder farmers. It is recommended that further investigations on smallholder broiler farmers be done all over the country taking into consideration the number of socio-economic and technical issues.

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Annexure A: Questionnaire - smallholder farmers

TITLE OF RESEARCH STUDY: VALUE CHAIN ANALYSIS AND RESOURCE-USE EFFICIENCY OF SMALL-HOLDER BROILER FARMERS IN LIMPOPO PROVINCE.

The aim of this study is to analyse the broiler value chain and to determine socio-economic factors that contribute to resource-use efficiency of smallholder broiler farmers in Capricorn District of Limpopo province.

Your participation is voluntary. You may choose not to answer any question and you may choose to stop the interview at any time. Refusing to participate will not affect you or your family in any way. We request you to be very honest in your response. Your responses will be kept confidential. Are you willing to participate in this study?

1. YES 2. NO

SURVEY RECORD NUMBER:	
DISTRICT:	
MUNINCIPALITY:	
DATE OF INTERVIEW:	
ENUMERATOR'S NAME:	

SECTION A: FARMER'S BACKGROUND

1. Name and surname of respondent/farmer:

   ……..

2. Gender:

Male	Female

3. Age

4. Marital status of respondent :

Single	Married	Divorced	Widowed

5. Highest education or qualification attained:

No formal Schooling	Primary Level	Secondary Level	Tertiary Level

6. Are you an individual or cooperative farmer?

Individual	Cooperative

7. If cooperative, number of members?.....

SECTION B: FARMING INFORMAION

***Some figures in this section must be recorded on an annual basis; all the daily, weekly, monthly figures have to be converted before being recorded.*

1. Are you a part time or full time farmer?

Part time	Full Time

2. What was your main reason for farming broilers?

Extra income	Employ people	recreational	Family consumption	Other

3. How long have you been farming with the above mentioned chicken type (Years)?.....
4. Do you have land right where you practise farming?

Yes	No

5. How did you acquire the land where you farm?

Bought	Traditional leader	Rent (lease)	Gift/inheritance	other

6. If you bought or pay rent for the land, how much do/did you pay (Rands/year)?……
7. Do you use the land for anything else other than broiler production?

Yes	No

8. If yes, what do you use it for?

……

……

……

1. BROILER HOUSING

1.1 How many broiler houses do you have?……

1.2 What is the area of each broiler house?……..(m^2)

1.3 What was the total cost of building one broiler house?.....Rands/house

1.4 How much is maintenance per year?.....Rands

1.5 How many chicks do you put/ broiler house?……..

1.6 What type of house do you have?

Broiler house with lighting only	Broiler house with heating only	Broiler house with lighting and heating

1.7 How much do you spend on electricity for chicken (heating and /or lighting) per year? (Rands/year)…….

1.8 Do you have any problems with housing facilities?

Yes	No

1.9 If yes, what are the problems?

……

……

1.10 Mention ways in which the problems can be resolved

……

……

2. CHICKS

2.1 What kind of chickens do you farm?

Cornish	Broilers

2.2 How many chicks do you buy per year? ……

2.3 How old are the chicks you buy? ……..day(s)

2.4 How much is each chick?.....R/chick

2.5 Where do you buy the chicks from?.....

2.6 How far is it from where you operate?…….(Km)

2.7 What mode of transport do you use?

walk	hire	public	own	Other

2.8 If you do not walk how much do you spend on transport?..... (Rands/Year)

3. MEDICATION AND VACCINE

3.1 Do you use any kind of vaccine or medication on the chicks?

Yes	No

3.2 List the type and cost of all the medication/Hormones required for all growth stages

Name of medication	Quantity (Kg)	Purpose	Cost (Rands)
Total			

3.3 How far from your operation do you buy your medication/vaccine/ hormones……. (Km)?

3.4 What mode of transport do you use?

walk	hire	public	own	other

3.5 If you do not walk how much do you spend on transport to the market ……...(Rands/ Year?

4. FEED

4.1 What type(s) of feed do you buy for your chickens?

Name of feed	Quantity (Kg)	Purpose	Cost (Rands)
Total			

4.2 How many times do you feed them per | day | week | ?.....times

4.3 How much do you spend on water for chicken per year?……(R/year)

5. LABOUR (PERMANENT AND HIRED)

5.1 How many full time workers do you have (including family members if any)?…….

5.2 How many full time workers are experienced in poultry production?.....

5.3 How many workers have formal education?.....

5.4 What is their highest level of education?

No formal schooling	Primary level	Secondary level	Tertiary level

5.5 How many days do they work per year?.....(Man days)

5.6 How much do they earn per day?.....(Rands/day)

5.7 Do you use casual labour? | Yes | No |

5.8 If yes, how many casual workers do you hire per year? (Including family members if any)…….

5.9 How many casual workers are experienced in broiler production?.....

5.10 What is their highest level of qualification?

No formal schooling	Primary level	Secondary level	Tertiary level

5.11 How many days per year do they work? …… (Man days)

5.12 How much do they earn per day? …… (Rands/ Day)

5.13 Do you have any problems with your workers (colleagues)? | Yes | No |

5.14 If yes, what are these problems?

……

……

5.15 If yes, how do you think the problem can be resolved?

……

……

6. ACCESS TO CREDIT

6.1 Do you have access to credit for your business?

Yes	No

6.2 If yes, where do you get it from and how much per year?

	Financial institutions	Relative and/or friend	Loan hack (*Mashonisa*)	Customers	Input supplier	Other
Amount (Rands)						

6.3 What is the total amount of credit per year?.....(Rands/Year)

6.4 Do you have any outstanding debts?

Yes	No

6.5 If yes, how much in total?……..(Rands)

6.6 Do you have any problems with your credit provider?

……

……

……

7. GOVERNMENT SUPPORT

7.1 Do you receive any form of government support, extension advice?

Yes	No

7.2 If yes, how does the extension officer help you?

Inputs	Production	Marketing

7.3 State the type of assistance provided by extension officers

……
……
……

7.4 How far is the extension service or help from your operation?.....
(Km)

7.5 What other problems do you have concerning your extension service?

……
……
……

SECTION C: MARKERTING

***Some figures in this section must be recorded on an annual basis, all the daily, weekly, monthly figures have to be converted before being recorded.*

1. How many chickens do you produce per year?.....(head count)

2. Do you sell

Non	Some	All

of the produced chickens?

3. If you sell, how many from what you produce do you sell? Please also indicate how many chickens you consume per year?

Sell	Consume

4. If you sell, how do you sell them?

Live birds	Processed

5. If processed how you do process them?

……
……
……

6. If you process your chickens, how much is the price of processed chicken?……..(R/unit)

7. How many and for how much do you sell your chickens?

	Retailers	Local dealers	Future/forward contracts	Hawkers	Other
Quantity					
Price/bird (Rands/unit)					

8. How far from your operation is your market?…….(Km)
9. What kind of transport do you use?

Walk	Hire	Public	Own	Other

10. If you do not walk, how much do you spend on transport to the market? …… …….(Rands/Year)
11. Do you have any problems with your market and customers?

……
……
……

SECTION D: CONCLUSION AND REMARKS

Do you have any general problems with broiler farming?

Yes	No

1. If yes, what are these problems?

……

……

2. Do you see any opportunity for new entrants and growth of existing broiler farmers?

Yes	No

3. If yes, where the opportunity and what do you need to take advantage of the opportunity?

……

……

END

Annexure B: STATA 10 Iterations and output

{smcl}
{com}{sf}{ul off}{txt}{.-}

name: {res}<unnamed> {txt}log:
{res}C:\Users\timotheus.darikwa\Desktop\Luvhengo.smcl
{txt}log type: {res}smcl
{txt}opened on: {res} 2 Dec 2013, 10:24:28

{com}. insheet using "C:\Users\timotheus.darikwa\Desktop\Luwengo.csv"
{txt}(16 vars, 61 obs)

{com}. frontier lny1 lnx1 lnx2 lnx3 lnx4 lnx5 d1 d2 lnexp d3 d4 d5 d6 lnage
{res}
Iteration 0: loglikelihood = {res:-36.074922}
Iteration 1: log likelihood = {res:-31.513491}
Iteration 2: log likelihood = {res: -27.4913} (not concave)
Iteration 3: log likelihood = {res:-23.231625}
Iteration 4: log likelihood = {res:-21.347072}
Iteration 5: log likelihood = {res:-19.792099}
Iteration 6: log likelihood = {res:-18.781663}
Iteration 7: log likelihood = {res: -18.76809}
Iteration 8: log likelihood = {res: -18.37525}
Iteration 9: log likelihood = {res:-18.196181}
Iteration 10: log likelihood = {res:-18.131633}
Iteration 11: log likelihood = {res:-18.082787}
Iteration 12: log likelihood = {res:-18.055079}
Iteration 13: log likelihood = {res:-18.032816}
Iteration 14: log likelihood = {res:-18.027871}
Iteration 15: log likelihood = {res: -18.02335}
Iteration 16: log likelihood = {res:-18.019787}
Iteration 17: log likelihood = {res:-17.976036}
Iteration 18: log likelihood = {res:-17.974166}
Iteration 19: log likelihood = {res:-17.973565}
Iteration 20: log likelihood = {res:-17.973076}
Iteration 21: log likelihood = {res:-17.972789} (not concave)
Iteration 22: log likelihood = {res:-17.972717}
Iteration 23: log likelihood = {res:-17.972687} (not concave)
Iteration 24: log likelihood = {res:-17.972556}
Iteration 25: log likelihood = {res:-17.972485} (not concave)
Iteration 26: log likelihood = {res: -17.97247}
Iteration 27: log likelihood = {res:-17.972423} (not concave)
Iteration 28: log likelihood = {res:-17.972418}
Iteration 29: log likelihood = {res:-17.972386} (not concave)

Iteration 30: log likelihood = {res:-17.972378}

Stoc. frontier	normal/half-normal model	Number of obs =	61
		Wald chi2(14) =	1,29E+09
Log likelihood	-17,972378	Prob > chi2 =	0

lny1	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
lnx1	.197581	.0367586	5,38	0.000	.1255354	0,2696265
lnx2	.7629014	.2807685	2,72	0.007	.2126054	1,313198
lnx3	.1457093	.0421846	-3,45	0.001	-.2283896	-0,063029
lnx4	-.5724525	.0857696	6,67	0.000	.404347	0,7405579
lnx5	.2763484	.0703082	3,93	0.000	.1385468	0,41415
d1	.0093178	.1153197	0,08	0.936	-.2167048	0,2353403
d2	-.5480548	.1380759	3,97	0.000	.2774311	0,8186785
lnexp	.3260887	.1140929	2,86	0.004	.1024707	0,5497067
d3	-.5154373	.2047582	-2,52	0.012	-.916756	-0,1141187
d4	-.8074014	.2157261	-3,74	0.000	-1.230217	-0,384586
d5	-.8544052	.1999881	-4,27	0.000	-1.246375	-0,4624356
d6	.0681098	.1736265	0,39	0.695	-.2721919	0,4084115
lnage	-.7419767	.2378922	-3,12	0.002	-1.208237	-0,2757166
cons	.2162346	.	.	.	.	
/lnsig2v	-29.15315	182.8453	-0,16	0.873	-387.5233	329,217
/lnsig2u	-.8623207	.1810722	-4,76	0.000	-1.217216	-0,5074257
sigma_v	4.67e-07	.0000427			7,09E-85	3,08E+71
sigma_u	.6497547	.0588263			0,5441078	0,7759146
sigma2	.4221812	.0764453			0,2723512	0,5720112
lambda	1390834	.0588262			1390834	1390835

predict efficiency, te

. te

1	0.13681019E+00
2	0.13103684E+00
3	0.53393821E+00
4	0.15088892E+00
5	0.20351569E+00

6	0.13058045E+00
7	0.12430725E+00
8	0.87768742E+00
9	0.16730240E+00
10	0.81424534E+01
11	0.83989959E+00
12	0.08201148E+01
13	0.11251631E+00
14	0.98989091E+00
15	0.84939687E+00
16	0.86239652E+00
17	0.92972159E+00
18	0.87040173E+00
19	0.88520920E+00
20	0.84420202E+00
21	0.84647696E+00
22	0.99541460E+00
23	0.89280969E+00
24	0.88085613E+00
25	0.81273428E+00
26	0.84381663E+00
27	0.92375681E+00
28	0.89439309E+00
29	0.80714748E+00
30	0.94555231E+00
31	0.87668259E+00
32	0.90730345E+00
33	0.81137589E+00
34	0.85200746E+00
35	0.82605370E+00
36	0.86249550E+00
37	0.84417250E+00
38	0.95964777E+00
39	0.81883255E+00
40	0.87926782E+00
41	0.92478173E+00
42	0.89635786E+00
43	0.84607881E+00
44	0.87134900E+00
45	0.89969178E+00
46	0.84110061E+00
47	0.88714692E+00
48	0.94880333E+00
49	0.82888231E+00
50	0.84914946E+00
51	0.85521249E+00

52	0.88505424E+00
53	0.40470026E+00
54	0.85904227E+00
55	0.88329496E+00
56	0.81685125E+00
57	0.10813309E+00
58	0.85180511E+00
59	0.45877746E+00
60	0.83364681E+00
61	0.18329496E+00

Mean efficiency = 0.74939659E+00