THE IMPACT OF SUPPLY CHAIN ON SUSTAINABILITY OF SMALL-SCALE POULTRY FARMERS IN RATLOU LOCAL MUNICIPALITY, NORTH WEST PROVINCE

by

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DECLARATION

I Letlhogonolo Selaledi_ hereby declare that the dissertation, which I hereby submit for the degree of MSc. Agriculture at the University of South Africa, is my own work and has not been previously submitted by me for a degree at this or any other institution.

I declare that the dissertation does not contain any written work presented by other persons whether written, pictures, graphs or data or any other information without acknowledging the source.

I declare that where information from a written source were paraphrase, it was cited and where exact words had been used those words are placed inside quotation marks and referenced.

I declare that I have not copied and pasted any information from the Internet, without specifically acknowledging the source and inserted appropriate references of used sources in the reference section of the dissertation.

I declare that during my study, I adhered to the Research Ethics Policy of the University of South Africa, received ethics approval for the duration of my study prior to the commencement of data gathering, and have not acted outside the approval conditions.

I declare that the content of my dissertation was submitted through an electronic plagiarism detection program before the final submission for examination.

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To all small-scale poultry farmers in Ratlou Local Municipality, for taking part in this study, “ka lo leboga bana ba ga Seitshiro le Mariba, tlogolwana tsa ga Ratlou kokomane tsa ga Tau”.

DEDICATION

This research dissertation is dedicated to my wife Mamatsheng Thato Selaledi and children (Gomolemo, Kopano and Molebogeng Selaledi).

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LIST OF ACRONYMS

AFMA	Animal Feed Manufacturer Association
ABSA	Amalgamated Banks of South Africa
CAES	College of Agriculture and Environmental science
CDF	Cumulative Distribution Function
COOP	Cooperatives
DAFF	Department of Agriculture, forestry and fisheries
DOC	Day old chicks
DOP	Day old pullets
FAO	Food and Agriculture Organisation of the United Nations
FNB	First National Bank
NGO	Non-Government Organisations
NW	North West province
NWK	Noord Wes Kooperasie
POLP	Point of lay pullets
RDP	Reconstruction and development program
RLM	Ratlou Local Municipality
SADC	South African Development Region
SETA	Skills and Education Training Authority
SSF	Small-Scale Farmers
SPSS	Statistical package for social scientists
UNISA	University of South Africa
USA	United States of America
ZAR	South African Rand

ABSTRACT

The aim of the study was to analyse the current supply chain in relation to the influence of suppliers, infrastructure, market, production process and distribution of products on sustainability of small-scale poultry producers at Ratlou Local Municipality, North West Province. The research also investigated how skills and knowledge of farmers contribute to sustainable operation of small-scale poultry farming, and socio-economic benefit of the farmers in the study area. All the seventy small-scale poultry producers for operating and non-operating farms or projects in the Municipality were interviewed. A structured interview was used to collect data which was captured and analysed using Statistical Package for Social Sciences version 24. About 41.4 % of small-scale poultry projects were no longer operating, only 52.9 % were functional and 5.7 % were operating during certain seasons. The results of the study further revealed that 91.4 % of small-scale poultry farmers in Municipality did not know the name of the chicken breed they were using on their farms. The results reveal adequate availability of infrastructure such as access to electricity, tarred roads and telecommunication networks.

The results of the Logit regression analysis revealed that the Logit coefficient estimates associated with payment level, credit availability, chick and feed suppliers made significant ($p < 0.05$) contribution towards sustainability of the small-scale poultry farm. The aforementioned variables may serve as bases for informed policy decisions aimed at ensuring sustainability of small-scale poultry production in the municipality. The current study identified the need for establishment for a proper integrated supply chain for small-scale poultry farmers.

Key terms:
Supply chain, Small-scale poultry farmers, poultry production, poultry houses, infrastructure and poultry market system

CHAPTER 1

1 INTRODUCTION

1.1 BACKGROUND OF SMALL-SCALE POULTRY PRODUCTION

Small-scale poultry production is practiced in many African countries including South Africa. A study conducted in Malawi indicated that the poverty level was low amongst poultry farmers compared to non-poultry farmers (Assa, 2012). This emphasises that participating in poultry production has the potential to reduce the level of poverty and increase household income. However, small-scale poultry farmers find it difficult to participate in commercial markets due to a number of challenges. Constraints include lack of capital investment to small-scale farmers (Agang *et al.*, 2000); lack of training exposure (Ali & Hossain, 2010); household size; and effectiveness of rural development programs (Botlhoko & Oladele, 2013). In this regard, government and Non-Government Organisations (NGO) often promoted small-scale poultry projects as development projects to improve livelihoods and alleviate poverty as they provide an excellent protein source (Macgregor & Abrams 1997) and to create income. Wethli (1999) reported rural poultry production as a valuable asset for local populations in developing countries, especially in Africa.

South African poultry production systems vary from naturally ventilated (open sided) housing at subsistence farming level, to technologically advanced climate controlled structures at commercial level (South African Poultry Association (SAPA), 2012). In the North West province poultry production systems vary from subsistence and small scale level to highly modernised large scale commercial farms (Francis, 2002). In South Africa, the poultry industry in terms of meat and eggs dominates the agricultural sector and is the main supplier of animal protein to the population of 52 million South Africans (Statistics South Africa, 2012). According to the Department of Agriculture, Forestry and Fisheries (DAFF, 2012[b]), poultry meat accounts for R23.1billion, eggs account for R6.9 billion and the chick industry accounts for R3.6 billion of the agricultural sector revenue. About 1.7 % of the North West Province (NW) population is employed in the agriculture sector (Statistics South Africa, 2007).

North West is the largest broiler producer in the country with 26 million birds produced annually (DAFF, 2016). This information does not include subsistence or small-scale farmers, who play an important role in ensuring food security and provide much-needed protein at household level. Mosimanegape (2016) during a personal interview, stated that in Ratlou Local Municipality (RLM), there were more than 30 active small-scale poultry producers. The majority of these farmers do not have access to formal markets, relying only on informal markets.

According to Kherallah & Kirsten (2001), small-scale farmers experience limited resources, insufficient and inadequate physical infrastructure, lack of basic education and marketing knowledge, lack of organisational support and encounter institutional barriers in marketing. Such challenges may affect the sustainability of the small-scale farmers.

The promotion of poultry production at small-scale level, should address access to credit, capital development, more efficient extension services, advancement in the quality control, reliable and healthy day old chicks, a proper feed supply and structured marketing system (Badubi, Ravindran & Reid, 2004). Ngemntu & Monde (2010) reported that the majority of small-scale farmers faced challenges in marketing their produce, due to inadequate road infrastructure and lack of transport to facilitate the transportation of their produce to the market. Inadequate marketing infrastructure is also the major barrier to the success of small-scale farmers. Other factors identified included policy proposals on contract farming and availability of market information. Encouragement with value adding and investment in rural infrastructure; could assist small-scale farmers. The current study focused on supply chain challenges that may affect the sustainability of small-scale poultry farmers in RLM.

I. **Small-scale farmer:** In South African context "a small scale farmer is one whose scale of operation is too small to attract the provision of the services he/she needs to be able to significantly increase his/her farm productivity" (Kirsten & Van Zyl, 1998).

II. **The term sustainability:** To sustain is literally "to keep in existence; keep up; maintain or prolong" (Neufeldt, 1988). Sustainability in this context refers to the ability of small-scale farm to continue operating in the future.

III. **Supply chain:** A supply chain is a combination of all factors that determine the nature, character and value of a product at the time of receipt by the end consumer (Peterson, Handfield & Ragatz, 2005).

1.2 RATIONALE AND MOTIVATION

The success of small-scale poultry farmers in RLM is minimal. Small-scale poultry projects in RLM operate for a short period. The role of the small-scale/community poultry projects is to provide food security and income to beneficiaries while allowing access to food at affordable prices to surrounding community. However, their role and objectives were not achieved in most cases. Small-scale poultry farmers particularly those producing broilers in RLM are confronted with serious supply chain challenges. Among the challenges is the competition small-scale farmers are facing from commercial broiler producers. According to Stats SA (2016) North West Province is one of the biggest producers (49.5%) of poultry products in South Africa. Research is needed to help small-scale poultry farmers to unveil underlying challenges, which when addressed, could help them compete with commercial farmers. This information would be helpful to policy makers for informed policy decisions aimed at ensuring the sustainability of the small-scale poultry producers in the study area. Such policies may allow the establishment of an effective supply chain for small-scale poultry producers in RLM. An effective supply chain would lead to sustainable small-scale poultry production and secure food for the beneficiaries and surrounding communities to improve their livelihoods.

1.3 AIM AND OBJECTIVES

1.3.1 Aim of the study

The aim of the study was to establish the impact of the supply chain on the sustainability of small-scale poultry projects in RLM of North West Province.

1.3.2 Objectives

The specific objective of the study:

a) To analyse the current supply chain in relation to suppliers, infrastructure, market, production process and distribution of products influence the sustainability of mall-scale poultry producers at RLM.

b) To determine how skills and knowledge of farmers contributes to sustainable operation of small-scale poultry farming and socio economic benefit of farmers at RLM

1.4 HYPOTHESES

The null hypotheses of the study:

a) The current supply chain in relation to principal occupation, annual records availability, payment level, credit availability, borehole water availability, day old chicks' supplier and feed supplier, do not have statistically positive influence on sustainability of the small-scale poultry producers at RLM.

b) The skills and knowledge of farmers do not contribute to sustainable operation of small-scale poultry farming and socio economic benefit of farmers at RLM.

1.5 OUTLINE OF THE STUDY

The research dissertation is divided into five chapters. Chapter 1 provides an overview of the study, focusing on the background, problem statement, research objectives; stating the hypotheses and justification and limitation of the study. Chapter 2 reviews the literature; supply chain in the context of suppliers, infrastructure, marketing and management process. Chapter 3 focuses on the methodology used to collect and analyse the data. The results are presented in chapter 4 and followed by the last chapter which includes discussion of findings, conclusion and recommendation.

CHAPTER 2

2 LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews the literature in an effort to explore the impact of the supply chain in the sustainability of smallholder poultry projects. The review is divided into five parts, which are further divided into subheadings. The first part focused on the socio-economic characteristics; suppliers, infrastructure, information and management skill and structured market for supply chain towards the sustainability of small-scale poultry farmers.

According to Akinola & Essien (2011), small-scale poultry farming has proved to be a useful tool for poverty alleviation and can improve the livelihoods of people living in rural areas. However, Ngemntu & Monde (2010) reported that majority of small-scale farmers faced challenges of marketing their product. Moreki (2007) also mentioned that low prices offered by chain stores, lack of slaughter facilities, lack of refrigerated transport, high chick mortality, high cost of veterinary drugs, and lack of service are some of the constraints faced by smallholder poultry farmers.

2.2 SUPPLY CHAIN ANALYSIS

A supply chain analysis allows us to assess the interconnections that exist at different transformative levels in the industry. According to Clark & Scarf (1960) a supply chain is a coordinated process where a number of entities work together in an effort to source raw materials, convert them into final product and deliver it to the consumer. It is a complex and dynamic supply and demand network. In this context, material and information flows in both directions of the supply chain. The materials go forward and information backward. The chain characterises the fully sufficient, sequence of operations which, starting from raw material and ending downstream, until it reaches the consumer (FAO, 2011). Poor coordination among players can result in high transaction costs. The supply chain concept arose from a number of challenges in the manufacturing setting; including the rising costs of production; the declining resources of manufacturing; shrinking product life cycles; and the levelling of the playing field

within manufacturing and globalisation of market economies (Beamon, 1998). Supply chain analysis offers justification for strategies positioning, theory and decision-making (Simchi-levi *et al*, 2004). Figure 2.1 shows a diagram of the supply chain process.

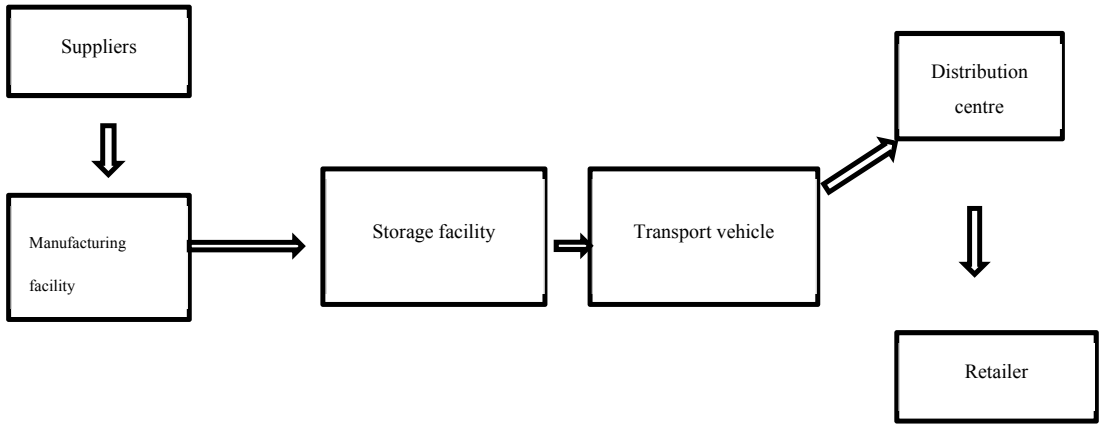

Figure 2.1: The supply chain process (Beamon; 1998)

Production inputs are transported to a manufacturing facility, after several stages of transformation, then go to a storage facility before the products can be delivered to distribution centres and retailers. This structure maps all the activities required to produce a product. The efficacy of the supply chain will be determined by accuracy (meeting standard and commitment), flexibility (adapting to changes in the market), strong network and momentum (Masuku, 2011).

2.2.1 Poultry production in South Africa

A summary of poultry production in South Africa is presented in Tables 2.1 and 2.2. These show the total number of broilers and layers produced in 2014 in South African poultry commercial farms. According to Table 2.1 North West Province is the biggest producer of broilers and Western Cape is the biggest egg producer in South Africa.

Table 2.1: Broiler production in South Africa.

Provinces	Number of Broilers	% of broiler birds
Eastern Cape	7 038 453	6,4%
Free State	6 067 200	5,5%
Gauteng	7 979 772	7,3%
Kwazulu-Natal	14 599 240	13,4%
Limpopo	2 486 300	2,3%
Mpumalanga	21 429 738	19,6%
North West	26 366 010	24,1%
Western Cape	23 205 600	21,2%
Northern Cape	157 000	0,1%
Total	109 329 313	100.0%

Source: SAPA (2014)

Table 2.2: Egg production in South African

Provinces	Number of layers	% of layers
Eastern Cape	4 671.327	3.6%
Free state	5 988 853	18.6%
Gauteng	4 089 876	23.9%
KwaZulu-Natal	1 542 903	16.3%
Limpopo	9 64 839	6.1%
Mpumalanga	2 583 712	3.8%
North West	5 258 976	10.3%
Western & Northern Cape	26 001 912	21.0%
Total	51102,398	100.0%

Source: SAPA (2014)

2.3 SOCIO-ECONOMIC IMPORTANCE OF SMALL-SCALE FARMERS

Poultry production has a significant effect on both the local and national economy. The primary goal of small-scale poultry farming is to provide income to beneficiaries, employment to women or improved livelihoods. This can be achieved by selling eggs and live birds which are the main production output of small-scale poultry farms. An egg contains about 13 % of protein. The consumption of eggs and chicken meat provides a valuable source of protein in the diet (FAO, 2015). According to the FAO (2015) food security report, an estimated 795 million people in developing countries are experiencing malnutrition and most of them are small-scale and subsistence farmers. About 20g of animal protein per capita per day is a minimum for consumption in developing nations but 75g is optimum for normal growth and development of children.

In Bangladesh the rearing of poultry significantly increased the overall socio-economic conditions of the small-scale farmers, empowerment of women in decision-making, employment opportunities and the protein intake of beneficiaries (Alam, 1997).

2.4 THE NATURE OF SUPPLY CHAIN IN POULTRY FARMS

The poultry industry exhibits a similar structure globally, with many different players in a supply chain. There are three main divisions within the supply chain commands, suppliers, production and distribution. Identification and understanding of the role of these players within the specific division are significant; they can be seen as the main drivers in the industry. Understanding the role and position of each player is important to gain more insight on how the sector functions in reality and how the final product reaches the ultimate destination. The bird is the central player in this game. Chicks need to be transported from one country to the other; from grandparent farm to the parent farm; the chick is then fed until it reaches the desired weight and is transported to the abattoir. Ghareeb & Böhm (2009) found that transport is one of the major causes of stress in broilers and affects the well-being of birds.

The bird needs energy and protein in order to accomplish its task. In South Africa, the Animal Feed Manufacture Association (AFMA) joins the party by supplying the poultry industry with

feeds. According to AFMA (2014), the poultry industry consumes more commercial feeds than any other animal industry in South Africa. Figure 2.2 presents a diagrammatic representation of the poultry industry in South Africa. It shows production inputs, the process and output. The poultry industry starts with the import of genetic stock for broiler and layer farms, which is a top secret breed conserved by some European countries and the United States of America (USA) (SAPA 2012). The South African poultry industry begins from grandparent stock which is one step below the imported pure line breed. The poultry industry has two separate sectors: egg production and broiler production. Different breeds and production methods are used in each. For egg production, Lohmann South Africa imports its genetic stock, the Lohmann breed from Europe. The breed is divided into two strains: brown and silver. Pullets are reared until they reach maturity and start laying eggs. Hy-line SA has a similar structure; however the Hy-line breed has silver and brown strains that are imported from USA (SAPA 2012). The broiler industry uses different imported breeds and has a different production chain to layers. Both layer and broiler production in South Africa are shown in Figure 2.2.

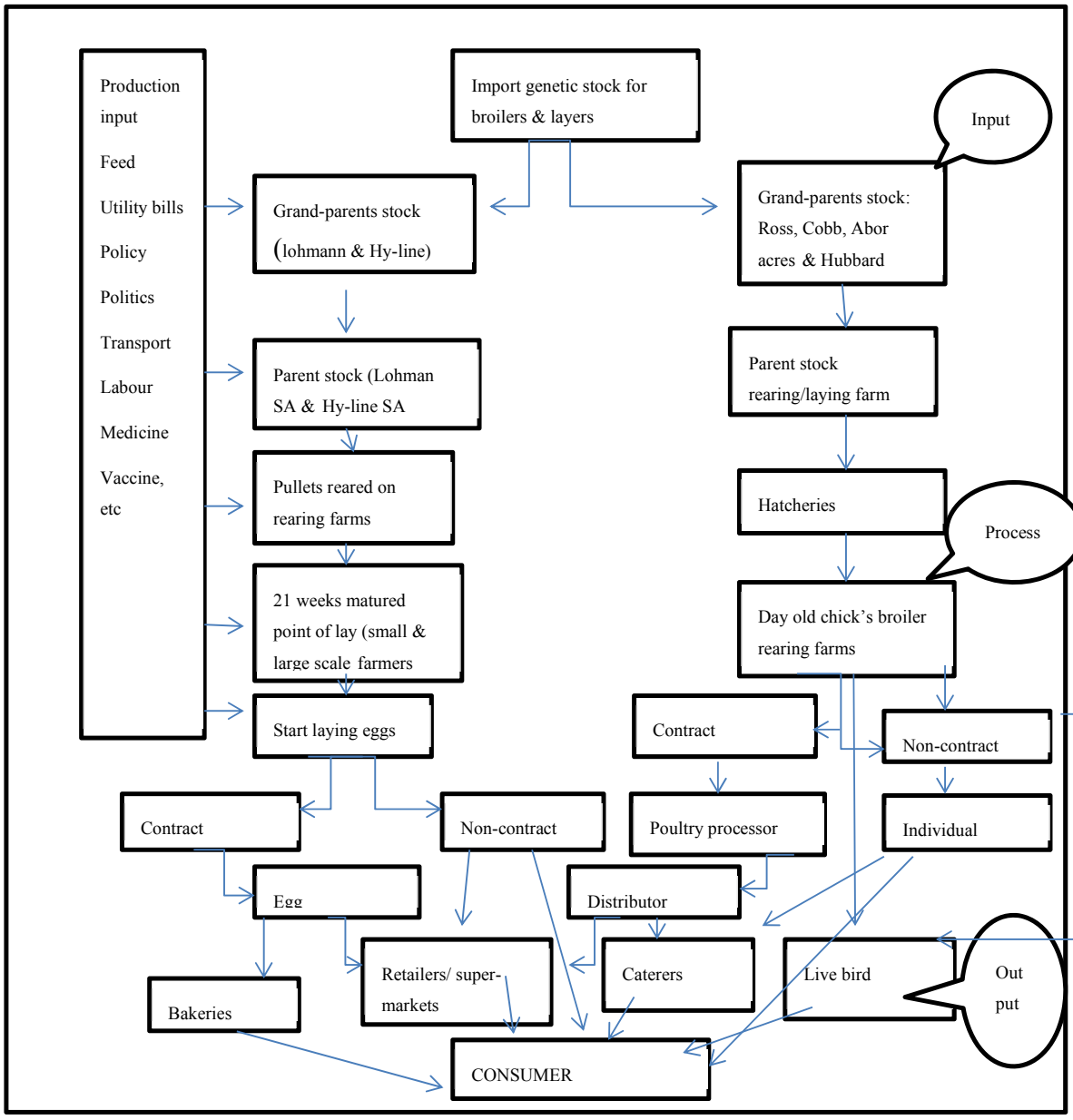

Figure 2.2: Broiler and layer supply chain (SAPA 2012)

2.5 SUPPLIERS FOR SUPPLY CHAIN OF POULTRY FARMERS

There are many suppliers involved in the supply chain of poultry farmers. They can either be found locally, nationally or internationally. It will all depend on the availability and quality of the product. In the poultry industry, hatcheries, layer breeders, feed suppliers, vaccines and medication suppliers and credit suppliers play a critical role in ensuring that a final product is delivered to the consumers. However, farmers may not participate in agriculture projects because of unavailability of funds, natural or physical resources (Botlhoko & Oladele, 2013).

2.5.1 Broiler chick suppliers

There are many different suppliers of day old chicks in South Africa. The quality of day old chicks is an important factor in the minds of broiler farmers or hatchery managers. According to SAPA (2013), 993 million day old chicks were produced in 2013. Alfa Chick is based in Pretoria, it supplies chicks to different broiler farms in Gauteng, Mpumalanga, Limpopo, Free State and North West provinces (Alfa-chicks, 2013). According to Alfa-chicks delivery schedule, they deliver to Setlagole village in Ratlou Local Municipality; and other places on Tuesdays. The distance from Pretoria Onderstepoort Alfa chicks' hatchery to Setlagole is 365.8 km (google maps, 2010). Fernandez (2012) reported that many hatcheries still travel more than 100km to deliver chicks to broiler farms and such distance can have a detrimental effect on the growth rate, feed conversion, meat yield and immune system of the chicks. Similarly, Chou, Jiang & Hung (2004) reported that a shipping distance within 50km radius had the lowest broiler mortality rate, for each km increase in travel distance, the cumulative mortality increased by 0.05%. Different types of roads have also been reported to have an impact on cumulative mortality; chicks transported over flat terrain had a lower mortality than those delivered over mountain roads, which showed 9.48% increase in cumulative mortality (Chou, Jiong & Hung 2004).

In contrast, Yassin *et al.,* (2009) reported that first-week chick mortality is related to many farm factors such as the age of the breeder, egg storage, length of storage at the hatchery, the strain, season, and company that supplies feeds to the breeder farm and hatchery. Considering all these factors, Nembilwi, Nesamvumi & Taylor (2002) suggested the need to develop an

appropriate broiler with distinctive genes that would make them capable of surviving the harshest conditions that small-scale farmers are facing.

2.5.2 Pullets or layer hen supplier

Different independent farms supply day old pullets across South Africa. In 2013, an estimated 23.6 million of day old pullets were produced (SAPA, 2013). Egg production farmers use different breeds for commercial laying flocks, including Lohmann silver, Lohmann brown, Hy-line silver and brown, and Amber-link (SAPA, 2013). In Ethiopia, the unavailability of pullets in time and high price of pullets, were some of the challenges affecting the sustainability of the small-scale poultry industry (Yemane, Tamir & Mengistu, 2016). Similarly, Moreki & Montsho (2011) in Botswana reported that irregular supply of pullets was one of the challenges facing Small-scale poultry farmers in Botswana. Yilma, *et al*., (2012) reported that in Dale, Ethiopia, a group of women involved in poultry production emphasised disease that causes death to their pullets; as a threat to sustainability of their project. The rearing of top quality pullets requires cooler temperatures. In South Africa, the KwaZulu-Natal Province Midlands have favourable temperatures for rearing pullets (DAFF, 2012[a]). It is not known if small-scale farmers in RLM buy pullets from commercial farmers around Ratlou Local Municipality or other parts of the Province or how this affects the sustainability of their project.

2.5.3 Feed supplier and storage effect on sustainability

2.5.3.1 Chicken feed supplier

Feed is one of the most important and expensive production inputs in the poultry industry (Moreki & Montsho, 2011). The continuous rising feed costs are a serious concern, and will arguably affect the sustainability of resource poor small-scale poultry farmers. In South Africa, the broiler industry in 2013 consumed 2.2 million tonnes of feed (SAPA, 2013). In Egypt low feed efficiency is caused by inconsistency of feed delivery to the farms and poor feed quality (Soliman, 1987). Younas & Yaqoob (2005) stated that in Ethiopia chicken feed is available from two groups; conventional and non-conventional feed resources. Concentrated chicken feeds are considered a conventional source and are commercially available at feed stores, while non-conventional are not. Yemane, Tamir & Menistu (2016) reported that the high price of

feed and lack of feed in their respective areas were some of the main constraints affecting small-scale farmers in Ethiopia. In the South African poultry industry, it is commonly known that poultry feed is presented as growing mash, crumbles or pellets. Cerrate *et al*., (2009) reported that chicks have a better feed conversion ratio when they are fed with smaller pellets or crumbles from day 0 to 12 than chicks fed mash on similar days. Opti-feeds in Lichtenburg, a town in the North West Province of South Africa manufactures feeds and deliver only to farmers who buy a minimum of 15 tonnes. Farmers who cannot buy in bulk normally buy feed at local Noord Wes Kooperasie (NWK) in most parts of North West Province (Opti-feeds, 2015).

2.5.3.2 Chicken feed storage

Poultry feed has to be stored and managed well. It is estimated that at least 70% of a broiler growers' input cost consists of feed cost (Louw *et al.,* 2011). Safalaoh *et al.,* (1998) reported that some feed supplied to small-scale farmers had a protein content between 14% and 24% in starter feed, while the label on the feed bags stated that it contained 23% protein. Contract growers (90%) procured feed as pre-mix form as it was less exposed to risk when compared to an on-farm mix (Louw *et al*., 2011). Incorrect labelling of feed bags is not the only problem facing small-scale poultry farmers. There are many factors that can affect feed quality, such as poor storage. Storing feed in unfavourable conditions could result in problems such as rodents destroying the feed bags, thus threatening the bio-security measures on a farm. Njobeh *et al*., (2004), reported that feed stored in a storage facility with high relative humidity (80%) had an impact on bird weight and feed conversion efficiency, as compared to birds fed feed stored at a low relative humidity (50%). They were heavier and had a better feed conversion efficiency.

Most poultry farms buy feed in bulk and store it in storage facilities for a very long time; this could also lead to loss of quality or spoilage (Valarezo *et al*., 1997). Fink-Gremmels (1999) reported that feed stored for a very long time in unfavourable conditions could also develop moulds (mycotoxins and aflatoxin), which can cause delayed growth and result in financial loss. To improve technical efficiency on the farm, proper feed management can be effective in improving the quality and quantity of production (Louw *et al*., 2011). Procurement of good quality feed and storage facilities are crucial. The continuous price increase of commercial poultry feed, is one of the challenges that affect poultry sustainability and future expansion of small-scale poultry farms (Yemane *et al*., 2016). However, it is not known if smallholder

farmers in RLM buy feed at a local cooperative in the nearest town and how it affects the sustainability of the farm; and whether they store feed in the poultry house or farm store.

2.5.4 Availability of poultry vaccines, medication and disinfectant

Small-scale poultry farmers should be educated about the importance of vaccinating their birds. Most of the infectious diseases that affect birds can be prevented through timely vaccination (Ahmed *et al*., 2011). In Ethiopia, women involved in small-scale poultry projects were trained to administer vaccines under supervision of veterinarians. They were also taught about the importance of proper storage of vaccines, scheduling vaccination and delivery of vaccines to control Newcastle disease, because this disease was reported as one of the biggest killer of their pullets (Yilma *et al*., 2012). According to Bragg & Plumstead (2003), continuous disinfection reduces the spread of infectious diseases. Poor sanitation affects feed conversion, broilers housed in an environment with excellent sanitation, had the lowest mortality and high feed conversion ratio (Pardeshi *et al*., 2011).

Jacob *et al*., (2008) identified general diseases as a less significant problem in small chicken flocks. However, this cannot be ignored because it has the potential to affect the profitability and sustainability of the farm. Veterinary drugs are expensive and not available in some villages. Thermostable vaccines that do not need a cold chain, can be appropriate for smallholder poultry farmers in remote villages, because small-scale farmers lack proper storage facilities (Moreki, 2010). Moreki (2010) further reported that only 2.11% of village chicken farmers use vaccines to protect their livestock against diseases, while 79% use herbal medicine to treat diseases. The remaining 18.89 % do not use vaccine or herbal medicine to treat the sick chickens. Traditional medicines are common in some parts of the African continent. According to Mwale *et al*., (2005) the conventional veterinary drugs are expensive and out-of-reach in some rural areas. Therefore, resource poor farmers in Zimbabwe, have opted to use herbal plants such as Aloe vera to treat their birds. However, little information is known about the effectiveness of this product on the treatment of chicken diseases.

2.5.5 Litter availability and effect on sustainability

Bedding plays an important role in the welfare of birds more especially broilers. It is part of the environmental enrichment that helps to absorb the faecal waste from birds (FAO, 2010). It is natural for birds to forage and dust-bath hence the use of bedding material becomes more relevant. Footpad dermatitis, is one of the disease that can affect chicken feet in the poultry house. Litter moisture is one of the main problems exacerbating this discomfort (Shepherd & Fairchild, 2010). There are many different types of bedding material available on the market; peanut hull, sand, pine shavings, rice hull, shredded paper and many other products (FAO 2010). According to Shields *et al*., (2004) birds that are restricted of bedding and ultimately given a choice between sand, pine wood shavings, rice hull and paper as bedding products, birds choose to dust-bath and forage in the sand, rather than in any other material presented to them. In the USA, some commercial poultry farmers are using sand as bedding. On the other hand, Taddele & Gebretinsae (2013) from the Netherlands reported a management error that resulted in 12 % mortality on pullets when suddenly exposed to sand bedding. However, it is not known if small-scale poultry farmers in RLM use bedding as part of environmental enrichment, and how it affect the sustainability of the poultry project.

2.5.6 Access to credit and loans.

The backbone of many economies in most parts of the world are small businesses. However, the lack of support (credit) that small businesses receive from stakeholders, is one of the causes of the slow growth rate of this sector (Mboyane & Ladzani, 2011). Access to credit for small - scale farmers remains a challenge in most parts of the developing countries, mostly sub-Saharan African (Chisasa & Makina 2012 and Aliber & Hall, 2012). According to Adeyemo & Onikoyi (2012), the government should provide soft loans to subsistence and small-scale farmers to ensure sustainability of poultry enterprises. Ike & Ugwumba (2011) stated that most small-scale poultry businesses are self-financing, which shows an underlying credit shortage. Badiru (2010) emphasised that access to credit would be likely to improve the well-being of a small-scale farmer's business. Any business needs finance in order to function efficiently. The better performance of small and large-scale poultry farms, is associated with the availability of capital or access to credit (Nimoh, Kwassi & Tham-Agyekum, 2011). However, this does not mean that formal financial institutions should neglect the financial needs of small-scale

farmers. Informal financial services (locally known as Machonisa) are available in small-scale farmer's areas; relatives to farmers, friends, area society and social clubs (stokvel) are sources of informal financial markets (Moobi & Oladele, 2012). However, the challenges to accessing these funds are a lack of enough services provided and not enough money loaned out to cover agricultural production costs (Moobi & Oladele, 2012). In Nigeria, access to credit plays a crucial role in poultry productivity, but most small-scale farmers depend on personal savings, or borrow money from friends and relatives to keep their farms sustainable (Olagunju & Babatunde, 2011). Nonetheless, it is not known if farmers in RLM have access to credit and how this affect the sustainability of their poultry projects.

2.6 INFRASTRUCTURE ON SUPPLY CHAIN OF SMALL-SCALE FARMERS

Infrastructure directly or indirectly arguably affects farmers, large and small-scale farmers or enterprises. Improved physical infrastructure has the potential to reduce the transaction costs (Makhura, Kirsten & Delgado, 2004). Delgado (1999) reported that agriculture in sub-Saharan Africa is facing challenges of poor infrastructure, which are a serious constraint facing small-scale farmers. Similar findings were reported in Botswana (Moreki & Montsho, 2013). Sub-Saharan Africa has the lowest level of infrastructure development; a quarter of the population has access to electricity and only 29 % have access to tarred roads (World Bank, 2007). Investment in basic infrastructure would have a positive influence in reducing inequality, poverty and increasing economic growth (Gnade, 2013). According to Chaminuka *et al*., (2008) in South Africa emerging farmers have better access to service infrastructure than before. In contrast, Gnade (2013) has reported that access to basic infrastructure in rural areas is lacking. According to Olagunju *et al.,* (2012) provision of market and road infrastructure has the potential to improve rural livelihoods and reduce migration from rural to urban. To promote agriculture in rural areas, the government needs to invest in public infrastructure such as educational services, health, safe water, physical infrastructure and provision of energy and road infrastructure (Wiggins, Kirsten & Lambil, 2010).

2.6.1 Roads infrastructure

Road construction is prevalent in most parts of South Africa, particularly in urban areas. The poor road infrastructure in the North West Province characterised by potholes and underserviced gravel roads, has a serious impact on the economic growth of the province (Vilakazi, 2009). Perishable agricultural products need to be transported from farm to market through access of good tarred roads. Linking rural areas and urban will reduce the waste of the farmers produce (Olagunju *et al*., 2012). Inadequate access roads are some of the prominent constraints small-scale farmers are facing, when they have to market their agricultural produce (Matsane & Oyekale, 2014). Small road improvement could have a huge impact on local economic development (Mu & Van de Walle, 2011). Agricultural goods such as day-old-chicks, pullets, feed supplies and many other production inputs have to be delivered to the farm. Proper roads are needed to facilitate the transportation of these farm production inputs.

In South Africa the Provincial, National and some local government, mainly district municipalities are responsible for road maintenance and construction (Department of Public Works, 2015). However, Olagunju *et al*., (2012) suggested that the local government must be empowered to maintain and construct new roads in their respective geographical locations. According to Ratlou Local Municipality Integrated Development Plan 2015/2016 (RLM 2015, page 18-24) the majority of communities within RLM have requested the municipality to construct tarred roads in their respective communities. Improved agricultural technologies and adequate road infrastructure, have the potential to increase market participation of small-scale farmers (Cunguara & Darnhofer 2010). Cunguara & Moder (2011) reported that extension officers are likely to target farmers who reside closer to a tarred road and majority of them are wealthy.

2.6.2 Access to agricultural extension services

The agricultural extension offices in Ethiopia, reported unavailability of transportation facilities as one of the major challenges prohibiting them from providing required extension and technical assistance (Yemane, Tamir & Mengistu, 2016). Access to agricultural extension offices is important to resource-poor farmers. However, lack of capacity and agricultural specialisation of extension workers are some of the problems that render this institution less

effective (Mmbengwa *et al*., 2009; van Tilburg & Van Schalkwyk, 2012). Extension services have the potential to increase farm production and income by 12% (Cunguara & Moder, 2011). "Extensionists usually persuade farmers to adopt new practices mainly because they have access to research and its results. They have received proper training that can be executed to benefit the farming communities" (Zwane, 2012). Oladele & Mabe (2010) reported that farmers in the North West province of South Africa had more contact with the extension officers in matters relating to their livestock. In contrast, Justus & Bebe (2013) reported that only a few farmers had access to institutions that provided support services such as veterinary service, training and extension. In a study conducted by Chaminuka *et al*., (2008) distance to agricultural extension services was identified as a major concern in terms of the longest distance farmers had to travel in order to access extension services.

2.6.3 Energy infrastructure

Energy infrastructure is arguably one of the service infrastructures that play a crucial role in the poultry industry. However, in India weak power supply and long power cuts are some of the major challenges small-scale poultry farmers are facing in the marketing of chicken meat (Gangwar, Saran & Kumar, 2010). Traditional fuels such as biomass and wood have been the oldest source of fuel in rural areas and mostly women were responsible for collecting and using this fuel. According to Kaygusuz (2011), energy investment in poor countries, tends to focus more in urban areas and neglect the needs of rural poor. Energy is needed for both household and agricultural production: light, heat, operating ventilation machines in poultry houses need energy to function (Byrne *et al*., 2005). However, in RLM it is not known which source of energy poultry farmer's use and how electricity effect on farm sustainability.

2.6.4 Access to chicken slaughter facility

A chicken slaughter facility "is a marketing infrastructure that leads to selling broilers at a proper time which help to reduce feed losses" (Soliman, 1987). In Botswana 70% of small-scale broiler farmers slaughtered their chicken in the backyard this showing that hygiene standard is not optimal. The lack of slaughter facilities reduces the chance that small-scale farmers enter the formal chicken market (Moreki, 2011). Backyard broiler slaughtering provides employment opportunities and better livelihood for a large number of semi-skilled

and illiterate workers. Therefore, the manual dressing system needs to be improved for health and hygiene purpose on food safety (Gangwar *et al*., 2010).

In South Africa, the hygiene standard for the slaughtering of poultry for human consumption is controlled by meat safety Act no 40 of 2000 (DAFF, 2006). Therefore, it is regulated that anyone who wants to sell chicken meat in a formal system (supermarkets, shops or restaurant) should adhere to the meat hygiene principles. Access to slaughter facilities could improve economic and feed efficiency (Soliman, 1987).

2.6.5 Poultry house infrastructure

To raise broilers and layers commercially under intensive and semi-intensive system, good housing is needed to protect birds from predators and unfavourable weather conditions (FAO, 2010). In developing countries, poultry houses of different sizes and shapes are constructed by households using local building material, mud bricks or timber. In such poultry houses there may be several rooms where chicks are brooded, pullets are reared and layers are kept either in cages or floor (FAO, 2010). According to Al-fataftah & Abu-Dieyeh (2007), 4-8 weeks broilers housed in closed and open-sided houses, exposed to 30 to 35 degrees Celsius and variable natural temperatures; significantly reduced feed consumption, body gain, and growth rate and feed efficiency. Furthermore, in summer broilers raised in open-sided poultry house, reach market age late and production costs increase significantly. Broilers reared in environmentally controlled poultry houses quickly reached market age (35 days) compared to broilers raised in an open sided broiler house, which normally take 42 days before being ready for market (Masuku 2011). Table 2.3 shows the different characteristics of two different broiler poultry houses.

Table 2.3: Characteristics of two poultry house

Climate controlled poultry house	Open-sided poultry house
Temperature controlled, heating during brooders stage only	Temperature difficult to control
Good artificial ventilation	Poor ventilation in hot weather
Expensive to build, not natural light	Cheaper to build, have access to natural light
Birds can reach market age faster than birds raised in open-sided house.	Fairly takes 6 weeks to raise a broiler chicken.

Source: SAPA (2012)

2.6.6 Access to borehole water and its effect on farm sustainability

Chickens are water dependent birds and they can become severely dehydrated if insufficient water is supplied. The Southern Africa Development Community (SADC) region is facing serious water shortages; it is estimated to be the second region in the world to face serious water shortages after the North Africa and the Middle East (Turton, 2000). Water scarcity is a serious concern in South Africa. In the North West Province under the Madibeng local Municipality, community members have been up in arms with the local municipality, complaining about the shortage of water (Davis & Lekgowa 2014). According to the Ratlou Local Municipality 2015 IDP budget, the number of households with portable water has increased from 2078 in 2001 to 4269 in 2014, only 5.2% of residents have piped water inside their dwellings. However, the majority of people without piped water has increased from 13597 in 2001 to 19277, in 2014 (RLM, IDP report, 2015). Furthermore, through the integrated development plan consultation; most communities within RLM have requested water pipe extensions to their newly build reconstruction and development program (RDP) houses.

2.6.7 Telecommunication infrastructure

Access to telecommunication is important. In Zambia, provision of internet has improved the livelihood of many people in rural areas. Local health institutes operate more efficiently, created new employment opportunities and generating new projects; for instance, a sunflower

farming project established by a young Zambian farmer, after he used the internet to do research (Stam, 2007). According to Aker & Mbiti, (2010) farmers in Ghana Tamalia are using mobile phones to send a text message to learn corn and tomato prices in Accra, which is 400km away. This practice can help to reduce the production costs for small-scale farmers. Instead of the farmer travelling a long distance to the market a short message service (SMS) can be used to get the relevant information needed. In South Africa, the mobile phone has also benefited most farmers. According to Alfa-chicks (2013), broiler farmers have to place an order for day-old-chick by phoning one of the sales representatives before a delivery. Telecommunication infrastructure plays an important role in the agricultural sectors.

2.7 INFORMATION AND MANAGEMENT SKILLS EFFECT ON SUSTAINABILITY

Farms with good management, knowledgeable and skilled workers, are in most cases prosperous. Small-scale farmers display different styles of management. The lack of knowledge about broiler production management, poor record keeping on farms and lack of support and encouragement in research about local poultry related problems, are some of the challenges smallholder farmers are facing (Badubi, Ravindran & Reid, 2004). Knowledge and information play a critical role in addressing farm production shortcomings (Opara, 2011). Some of the aspects that hinder access to agricultural technical information, are the unavailability of agricultural extension officers and long distances for consultation (Lwoga, Ngulube & Stilwell, 2010).

2.7.1 Farmer education and training effect on sustainability

The research reveals that literate farmers respond positively to new innovations compared to illiterate farmers, thus improving the farm efficiency and returns (Oni, Oladele & Oyewole, 2005). To run a farm efficiently, farmers need to equip themselves with knowledge by attending non-formal education workshops such as farmer's days, as well as seminars that will help them to strengthen their knowledge and information capacity (Maveska-Tasevska *et al*., 2013). To improve production of small-scale poultry farms, the technical skills of farmers should be thoroughly scrutinised. Technical equipment used and collective marketing initiatives should be considered (Justus & Bebe, 2013). Grobbelaar, Sutherland & Molalakgotla

(2010) reported that the white leghorn layer breed is superior to indigenous breeds such as Potchefstroom Koekoek, Venda, Ovambo and Naked-neck; in terms of the number of eggs produced per year. Hence, it is important that farmers should have a basic knowledge and training of the breed or strain characteristics or performance so that they can make informed decisions.

Maveska-taveska (2013) emphasises that knowledge can transform society. Knowledgeable farmers have shown good management skills and satisfactory economic production outputs. According to Oladele (2011), experience in farming is crucial and that comes with practice. The more emerging farmers practice their trade, the more experience and knowledge they acquire. Knowledge and information play a critical role in increasing farm production (Opara, 2011). In Bangladesh, Ali and Hossain (2010) reported that training exposure, education, broiler farming experience and contact with extension officers, have a positive impact on broiler farm performance. Figure 2.3 shows that formal knowledge and non-formal education play a big role in ensuring farm technical efficiency.

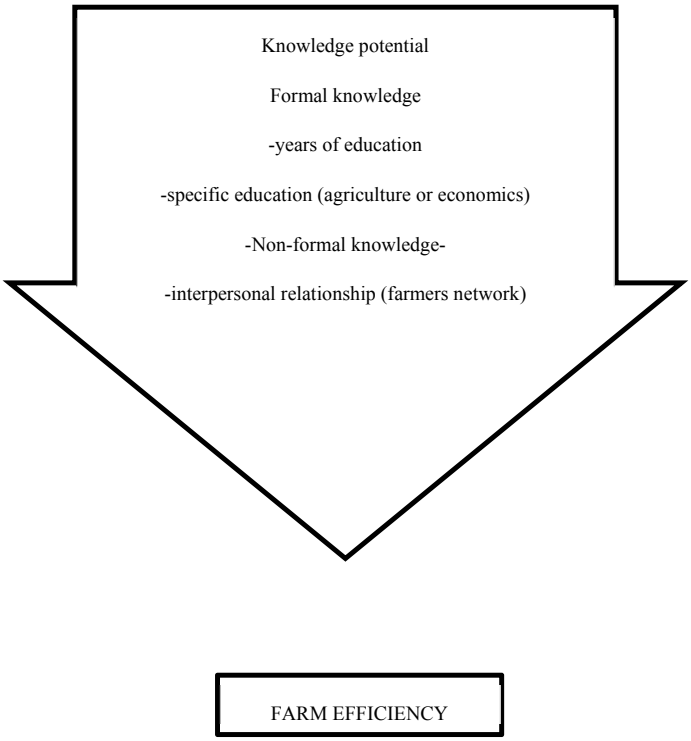

Figure 2.3: Sources of knowledge development assumed to influence farm efficiency (Manevska-Taveska, 2013).

2.7.2 Access to technical information and its effect on sustainability

According to Kawsar *et al*., (2013) scientific intervention has proven to be very useful and increased farm profit when applied to farms that recently performed unsatisfactorily. The key elements to get satisfactory results in broiler farming, were training small-scale broiler farmers; and the introduction of good management practices in the farm. Challenges that farmers were facing included globalisation of farm products. The farmers in Ghana are forced to search for more information and knowledge regarding the market opportunities available in their country (Chisenga, Entsua-Mensah & Sam 2007). Louw *et al*., (2011) identified low education as one of the risk factors posing a threat to bio-hazard zones for animal disease outbreaks. If poultry farmers are exposed to information, they would be able to share and accept new ideas and innovations; and practice new technologies (Gueye, 2009). Experience and technical education have a positive effect on farmers' technical efficiency (Yusuf & Malomo, 2007).

2.7.3 Record-keeping

Record-keeping is an important management aspect. There are many types of farm records, which farmers need to keep for future use to improve management. Records can be classified as follows: production records; financial records; resource records and supplementary records. A financial record includes income from sales of birds or bird products, expenditures include feed, vaccines and maintenance of farm equipment (Poggio, 2006). Arzeno (2004) has indicated that the recent global economic crisis has an impact on farm management in general. Farmers cannot continue doing business the way the previous generation of farmers used to run farms. The reason most small-scale farmers do not keep a detailed records, is because they believe that these records are not beneficial to them. According to Muhammad, Tegegne & Ekanem, (2004), successful farmers keep records better than unsuccessful farmers. High levels of illiteracy and low numeracy levels are some of the factors that prohibit farmers from keeping detailed records (Minae *et al*., 2003). According to Than-Agyekam, Appiah & Nimoh (2010) almost all small-scale farmers keep production and financial records. Some keep animal health records, while few keep supplementary non-computerised records. However, it is not known if farmers in RLM keep records satisfactorily and if record keeping would impact on the sustainability of the poultry farm.

2.8 MARKET ON SUPPLY CHAIN OF SMALL SCALE FARMERS

Poultry products (meat and eggs) are rich in proteins, affordable and have no or limited cultural boundaries (Mengesha & Abda, 2010). However, in order for these products to reach end-users, they need to be packaged and sold to consumers. Most of the small-scale farmers still use the old tradition of selling their produce directly from their farms to the communities (Aguglia, De santis & Salviom, 2009). They prefer this method because many small-scale farmers are struggling to sell their goods at formal markets, due to challenges such as: poor market prices and poor physical infrastructure; lack of access to market information; lack of group participation; non-availability of contractual agreements; and lack of expertise regarding grades and standards (Mkhwanazi, 2009 and Jari & Fraser, 2009). In the past few years, there has been research conducted on how small-scale farmers in South Africa and other developing countries can successfully participate in food supply chains (Ortman & King, 2010). These marketing challenges are not only faced by small-scale poultry farmers (Antwi & Seahlodi, 2011). Small-scale pig farmers in South Africa also face similar marketing challenges such as: poor marketing information access; lack of finance; poor market infrastructure; and lack of access to the existing high-value markets. Some factors that prohibit small-scale farmers from accessing markets are physical access to markets, the nature of access to the market and farmer skills (Mangingxa, Alemu & Van Schalkwyk 2009).

2.8.1 Broiler market and marketing age

Broiler marketing age has evolved with time. In 1968 the slaughter or marketing age of broilers was 62 days. As a result of advancement in science and technology the marketing age in 1998 was reduced to 42 days (see Table 2.4) but recently it has advanced to 35 days old (SAPA, 2012). However, majority of small-scale farmers still market their broilers between 35 and 56 days, simply because some birds are underweight at 35 days old (Masuku, 2011). The slaughter/ marketing age can be influenced by many factors. The majority of the small-scale broiler producers are selling their produce to individuals or vendors as live birds or carcasses and less often to retailers; mainly because of lack of refrigeration and slaughter facilities (Moreki, 2010 and Badubi, Ravindran & Reid, 2004).

Table 2.4: Broilers: genetic development

TRAIT	1968	1998	2004	2012
Slaughter age	62 days	42 days	38 days	35 days
Live Mass	1.8kg	1.79kg	1.82kg	1.8kg

Source: SAPA (2012)

Masuku (2011) further reported that consumers are paying more for a bird produced from large commercial farms compared to birds produced by small-scale farmers. Islam, Uddin & Alam, (2014) reported that despite all the challenges small-scale farmers encounter, in Bangladesh small-scale independent broiler farming is a profitable business for rural farmers. However, lack of efficient marketing systems such as collection, storage, processing and marketing of poultry products (egg and meat) hampers production growth (Islam *et al.,* 2014). According to Oguttu *et al*., (2014) informal vendors in Pretoria South Africa, are selling ready to eat chicken at taxi ranks. Taxi-rank-restaurant owners purchased only 12.7% of live birds from small-scale farmers the rest was purchased from retailers as processed slaughtered chicken. This shows that the informal market for live birds is small, compared to the formal market. With the changes occurring in the market and increasing competition, small-scale farmers need to improve the efficiency of their broiler farms in order to increase their production and enter the formal market (Masuku, 2011).

2.8.2 The Egg market

The egg is a cheap source of protein and many low-income consumers can afford it. However, the recent hen housing alternatives in the United States and other European countries that will replace the conventional cage system, will likely affect the price of eggs and marginally decrease egg consumption (Sumner *et al*., 2011). In South Africa more eggs were consumed in 2012, 153 per capita as compared to 147 per capita in 2013. This shows a decline and is a concern for the local egg industry (SAPA 2013). Decrease in consumption might be related to a lower disposable income or price increase of the product. Table 2.5 shows the genetic progress in layers. In 2010 chickens were laying an average of 289 eggs per year as compared to 309.8 in 2012. This shows an increase in production and decrease in feed intake per kg for every egg produced. In Ethiopia, exotic eggs sold by small-scale poultry farmers were in

demand in 2016 and fetched a high price due to shortage of local egg supply in the market (Yemane, Tamir & Mengistu, 2016).

Table 2.5: Layers: genetic development

TRAITS	2010	2011	2012
Eggs per hen per annum	289.0	303.2	309.8
Kg feed per kg eggs	2.50	2.37	2.32
Mortality per annum	7.017%	7.017%	7.017%
% hen-day production	79.7%	83.1%	84.6%

Source: SAPA (2012)

2.8.4 Distance to the market

According to Vecerek *et al*., (2006), longer transport distances to the processing plant has an impact on broiler mortality, especially in hot weather. Gausi *et al*., (2004) concluded that long distances to reliable markets is one of the chicken marketing constraints experienced by small-scale farmers, hence the majority of them sell their chickens at markets closer to them. Due to the constant increase in fuel prices, solutions are needed in terms of bringing various stages of production closer to one another. Proximity to market centres influence farmers decision to choose the main market for their products (Tung & Costales 2007)**.**

2.8.5 Access to supermarkets or retailers

The factors that facilitate the participation of small-scale farmers in markets are infrastructure and access to transportation. Supermarkets can play a big role in small-scale farms by increasing income growth and reducing poverty. However, supermarkets prefer to do business with large-scale farmers because they have assured a steady flow of high-quality products (Costales *et al*., 2005). According to Rao & Qaim (2011), supermarkets can play an important role in developing countries by offering farmers an opportunity to participate in a modern high-value supply chain. Similarly, Louw *et al*., (2007) stated that supermarkets can serve as the facilitator of market entry for the emerging agricultural farmers. However, success will be determined by the commitment and effort from both the farmer and supermarket. Louw *et al*.,

(2007) further reported that supermarkets can assist farmers in terms of providing interest-free loans, an unlimited market for produce, technical support and training in quality standard. Therefore, adaptability of small-scale farmers in a new market is crucial (Louw *et al*., 2008). Access to markets for small-scale poultry farmer is vital for exploiting the potential of poultry production to improve livelihoods of rural livestock farmers (Tung & Costales, 2007).

2.8.6 Farm profitability effect on sustainability

There are many factors that determine the profitability of poultry farms. The farming system, genetic potential, feed prices, size of the farm, management and other factors influence profitability and sustainability of farming enterprises. For a farm to run efficiently it has to make a profit (Gilewski, Runowski & Wezyk, 2015). According to Wainaina, Okello & Nzuma (2012) small-scale contract poultry farming in Kenya seems to be the most profitable business as compared to independent poultry farms. Miyata *et al.,* (2009) believes that contract farming can increase the income of small-scale farmers. Ike & Ugwumba (2011) similarly reported that broiler enterprise could be a profitable business venture if properly managed. However, Ali & Hossain (2010) reported that 78% of broiler farmers in Bangladesh had low to medium performance, while only 22% experienced high performance. However, it is not known if smallholder poultry farms in RLM are profitable.

2.9 CONCLUSION

To remain competitive in the agricultural industry, farmers need to be more sophisticated in terms of how they market their products. Some Researchers have emphasised the importance of an integrated supply chain in the poultry sector. However, the majority of small-scale farmers experience the problem of poor supply chain from suppliers to structured marketing. Supermarkets still prefer to do business with large-scale farmers because they are assured a steady flow of high-quality products. A policy initiative to stimulate the change in this sector is needed. While policies and other initiatives can be addressed, small-scale farmers need to become more competent, because the industry is rapidly changing, becoming more sophisticated.

CHAPTER 3

3 MATERIALS AND METHODS

3.1 INTRODUCTION

This chapter describes the research methodology used during the field data collection and the method used to analyse the data. The chapter also covers the materials used in the study, how the materials were prepared, the research protocol and ethical clearance. The description of the research site is also presented in this chapter.

3.2 DESCRIPTION OF THE STUDY AREA

Ratlou local Municipality is a rural municipality situated in the Ngaka Modiri Molema District municipality (NMMDM) in the North West province. It shares its border with three other local municipalities (Naledi, Tswaing and Mafikeng local municipality) and the Republic of Botswana. The municipality is divided into fourteen wards. Some of the main villages making up the municipality are Madibogo, Kraaipan, Madibogopan, Disaneng, Maretsane, Makgobistad, Tshidilamolomo, and Logageng. The RLM is a semi-arid area, the temperature ranges from 3 °C to 21 °C (37° to 70°F) in winter and 17° to 31° Celsius in summer (South African venues, 2013). Annual rainfall totals about 360 mm (about 14 in), with almost all of it falling during the spring and summer months, between October and April. The main source of income in RLM is agricultural projects and government social grants (Stats-SA, 2011). The majority of the people (87.6%) in RLM speak Setswana, the total area is 4,884 km^2 with a population of over 100 000 people (Ratlou Local Municipality, 2015). Figure 3.1 is a map that shows North West province. Figure 3.2 shows four district municipalities of the North West province which are Bojanala Platinum District, Ngaka Modiri Molema, Dr Ruth Segomotsi Mompati and Dr Kenneth Kaunda. The local municipalities under Ngaka Modiri Molema district municipality are: Ratlou, Tswaing, Mahikeng, Ditsobotla and Ramotshere respectively. Table 3.1 shows all the villages and municipal wards that fall under Ratlou Local Municipality (RLM) with Madibogo village being the only village within RLM that has three wards (ward 6, ward 9 and ward 12).

Figure 3.1: Map of North West Province in South Africa (Google Map: 2016)

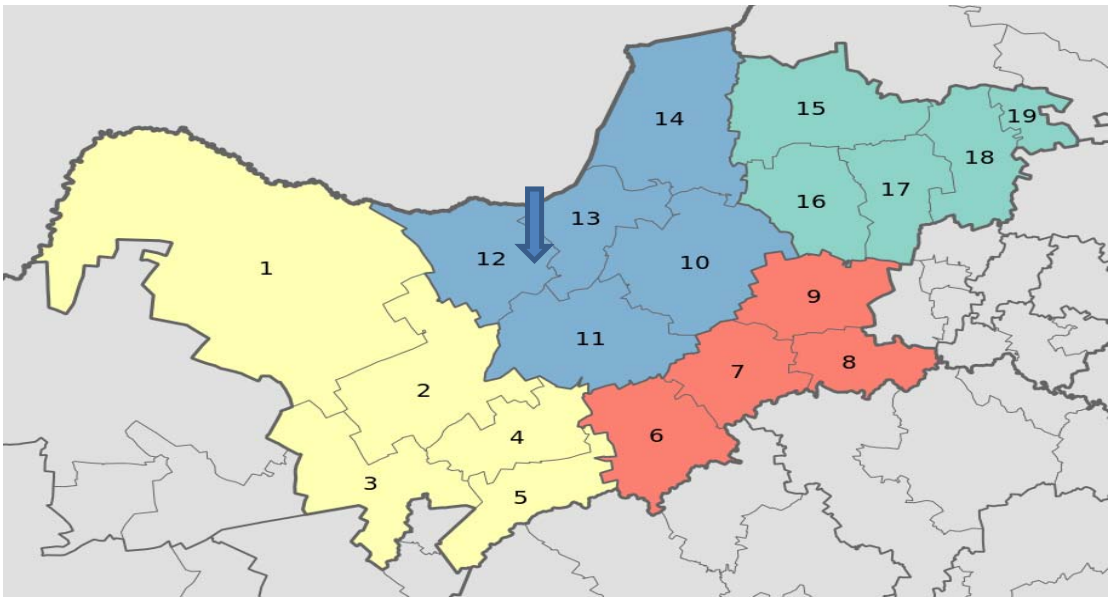

Figure 3.2: Four District municipalities of the North West Province (Google map 2016)

Table 3.1: Ratlou Local Municipality Wards and villages.

WARD	VILLAGES
01	Dingateng Mabule Mathateng Masamane Tshidilamolomo Makgori
02	Makgobistadt, Loporung, Ditloung, Mayaeyane, Sasane, Selosesha & Logageng
03	Disaneng
04	Moshawane, Logageng & Matloding
05 & 14	Setlagole
06	Madibogo (Tlhaping & Lohatlheng)
07	Madibogo-pan & Diolwane
08	Kraaipan (Gathulo & Tlhakajeng)
09	Madibogo (Motsitlane)
	Madibogo (Gareleng)
10 & 08	Mareetsane
11	Kraaipan
12	Madibogo (Morolong Lenganeng & Dikgatlhong section)
13	Thutlwhane & Setlwatlhwe

3.3 MATERIALS AND METHODS USED IN THE STUDY

3.3.1 Resources / materials used

The study was conducted to assess the impact of supply chain of small-scale poultry farmers in RLM. Therefore, a structured questionnaire was developed to conduct survey on the status of supply chain on the existing projects in RLM. The Ratlou Local municipality is characterised by more than 25 villages which are ruled by the tribal Authorities (Dikgosi le Dikgosana). Table 3.2, presents a list of all poultry projects that participated on the current study from Ratlou local municipality. The table further presents the status of poultry projects at the time of data collection whether the house was operating or non-operating. This Table also shows the number of projects (broiler and layer) sampled per villages.

Table 3.2: RLM villages and poultry projects

Number	Villages	Number of projects	Current status	Broiler or layer
1	Dilwane	1	Not operating	Broiler
2	Disaneng	5	All operating	Broiler & layer
3	Kraaipan	4	1 operating 3 not operating	Broiler & layer
4	Logageng	6	3 operating 2 not operating 1 seasonal farmer	Broiler & layer
5	Madibogo	20	13 operating 6 not operating 1 interval	Broiler & layer
6	Madibogo-pan	3	2 operating 1 not operating	Broiler & layer
7	Makgobistad	2	1 operating 1 not operating	Broilers
8	Mareetsane	3	2 operating 1 not operating	Broilers
9	Masamane	5	I operating, 3 not operating,	Broiler & layer
10	Mathateng	1	1 not operating	Broiler & layer
11	Matloding	5	4 not operating 1 operating	All layers
12	Sasane	2	All not operating	Layers
13	Setlagole	9	6 operating, 2 no, 1 seasonal farmer	Broiler & layers
14	Setlhwatlhwe	2	1 operating 1 interval	Broiler
15	Thutlhwane	2	1 operating, 1 not	Broiler & layer

3.3.2 Sampling method

All operating and non-operating small-scale poultry projects (meat & egg) in RLM were sampled using total population sampling method. The small-scale poultry farmers were divided into groups that differed in production performance, i.e. group A (< 300 Chickens) group B 301-600, group C (601-900) group D (901 - 2000) and group O (temporarily not operating/seasonal farmers). The groups were sampled randomly.

3.3.3 Data collection tools

A structured close-ended questionnaire was prepared to collect the data. Questions in the questionnaire followed a logical flow for ease of comprehension. A digital camera was also used as an important tool to capture the status of the poultry houses.

3.3.4 Method of data collection

Farm to farm visits method was used to collect the data through the use of questionnaires. Questionnaires were written in simple English. The questionnaire covered questions relating to the suppliers, infrastructure, management aspects, marketing and production. During the data collection, questions that were not clear were translated into the local language, mainly Setswana. The data was obtained through face to face structured interviews with the project owner or beneficiaries. The questionnaire was divided into sections informed by the specific objectives of the study. It was pretested, validated and subjected to reliability test to improve the efficiency of the use of the questionnaire. The respondents used for the pretesting of the questionnaire were not considered in the main survey.

3.3.5 Methods of data capturing

The collected data was sorted, coded and captured using Microsoft Excel spreadsheet and data was exported to the Statistical Package for Social Science (IBM SPSS version 23, 2015). The data was captured in the spreadsheet, screened and edited for ease of analysis.

3.4 DATA ANALYSIS

The variables were aligned according to the objectives of the study for analysis. The demographic data and other headings in the questionnaire i.e. location of the farm, description of the farm, operational management aspects, sales and marketing etc. were subjected into descriptive statistics (graphical and numerical summaries) using frequency tables, histograms and pie charts. Preliminary descriptive statistics of the variables selected was performed. Further statistical analysis was conducted to analyse the data. The Logit regression model was

used to analyse the determinants of supply chain factors for the sustainable operation of small-scale poultry projects.

3.4.1 Logit regression model

The Logit regression model was used to analyse the effect of supply chain on the sustainability of small-scale poultry farmers in RLM. The Logit model was used to model the dichotomous outcome of variables. The dependent variable was dichotomous where 1 denotes that poultry farms operate normally and 0 denotes that a poultry farmer is not operating sustainably. In the Logit model, the log-odds of the outcome are modelled as a linear combination of the predictor variables. The Logit function is specialised as the inverse of the sigmoidal used in mathematics, particularly in statistics. When the functions parameter represents a probability p, the Logit function gives the log-odds or the logarithm of the odds pl (1-p). The Logit of a number p between 0 and 1 is given by the formula:

$$logit\ (p) = \log\left(\frac{p}{1} - p\right) = \log(p) - \log(1-p) = -\log(\frac{1}{p} - 1). \quad (1)$$

The logistic function of any number α is given by the inverse –Logit:

$$logit - 1(\alpha) = \frac{1}{1} + \exp(-\alpha) = \frac{\exp(\alpha)}{\exp(\alpha)} + 1. \quad (2)$$

If p is a probability, then $p/(1-p)$ is the corresponding odds; the Logit of the probability is logarithm of the odds. Similarly, the difference between the Logit of two probabilities is the logarithm of the odds ratio (R), thus providing a shorthand for the correct combination of odds ratios simply by adding and subtracting:

$$\log(R) = \log(\frac{\frac{p1}{1-p1}}{\frac{p2}{1-p2}} = \log\left(\frac{p1}{1} - p1\right) - log\ \left(\frac{p2}{1} - p2\right) = logit(p1) - logit(p2) \quad (3)$$

So putting all this together, the key equation (usually termed the "multivariate logistic regression equation" or "multivariate logistic regression model") to which one fits the data is:

$$\log\left(\frac{pi}{1} - p1\right) = \alpha + \beta 1XI1 + \beta 2Xi2 + \cdots \beta pXip$$

Where Pi is the probability and that Yi is 1

$Pi/(1-pi)$ Are called the "odds". In the analysis, the function is estimated with the maximum likelihood method and Y=1 denotes that the poultry farm operates normally and 0 denotes that a poultry farm is not operating. The supply chain of the small-scale poultry farmers can be described in different ways. The current study focused on the supply chain of small-scale poultry farmers to determine the challenges that affect sustainable operation. The independent variable considered in the study are presented in Table 3.3.

Table 3.3: Explanatory variable labels and their expected effects

Variable	Type	Description and value	Expected Sign
Operating (Sustainability) (Pi)	Binary	Operating poultry project for sustainability: Operating=1, Not operating=0.	
Gender (β_1)	Binary	Gender: Male=1; 0=Female	+
Age (β_2)	Continuous	Age of respondents	-
Principal owner (β_3)	Nominal	Owner of the project or member of project/farm worker	+
Number beneficiaries (β_4)	Continuous	Number of beneficiaries per project	-
Size –farm (β_5)	Continuous	Size of the poultry farm (number of chickens per farm)	+
Annual records (β_6)	Binary	Availability of annual records: Yes=1, No=0	+
Business plan (β_7)	Binary	Do you have business plan? (Yes=1, No=0)	+
Sales calendar (β_8)	Binary	Availability of sales calendar: 1=Yes, 0=No	-
Distance-market (β_9)	Continuous	Distance from the farm to the market (km)	+
Type of Payment (β_{10})	Binary	Monetary payment, product or both	+
Payment-level (β_{11})	Continuous	Payment level (amount of money) paid to beneficiaries in rands.	+
Expenditure (β_{12})	Continuous	How much do you spend on production cost	+
Credit availability (β_{13})	Binary	Availability of credit to respondents: Yes=1, No=0	+
Transport expenditure (β_{14})	Continuous	Amount of money spent on transport	+
Income-after-sales (β_{15})	Continuous	Income of the project after sales	+

Tar road (β_{16})	Binary	The availability of the tar road in the village as supply chain infrastructure; 1=Available, 0=Not available	+
Electricity available (β_{17})	Binary	Availability of electricity per respondent: Yes=1, No=0.	+
Borehole water available (β_{18})	Binary	Availability of boreholes per respondent: Yes=1, No=0	+
Dept agric offices available (β_{19})	Binary	Availability of department of agriculture offices in the study area: Yes=1, No=2	+
DOC_supplier (β_{20})	Nominal	Availability of day old chicks suppliers in the area	+
Feed supplier (β_{21})	Nominal	Availability of feed supplier on the study area	+

[A positive sign implies that a unit increase in the explanatory variables leads to an increase in the probability of normal operation of the small-scale poultry farm]

3.6 ETHICAL CLEARANCE

Ethics application was submitted to UNISA college of Agriculture and Environmental Science (CAES) research committee. The ethical application was approved as (Ref. Nr.: 2014/CAES/085). The importance of the study was explained to farmers and participation was voluntary. Bio-security measures were applied (disinfection before entering the farm: car wheels, clean lab coats and shoes were disinfected). The shared information by farmers were treated confidentially.

3.7 SUMMARY

The study was conducted at RLM, which is situated in North West province of South Africa. All participants representing 70 poultry projects were interviewed using the questionnaire. The questionnaire was used as a primary tool for collecting data from farmers. The data was analysed using descriptive statistics and Logit regression analysis.

CHAPTER 4

4 RESULTS AND DISCUSSION

4.1 INTRODUCTION

The data capture and analyses have been discussed in the previous chapter. This chapter present and discusses the results of the analyses of the field survey that was carried out in RLM. The data was collected from seventy small-scale poultry projects from operating and non-operating farms. Descriptive statistics, correlation and Logit analysis were employed at significant level of $p < 0.05$. Logit regression analysis was used to correlate supply chain variables contributing to the normal functioning of the of small-scale poultry production.

4.2 DESCRIPTIVE STATISTICS

The results from the descriptive statistics was analysed using the frequency and charts. The descriptive results are presented in tables and figures. The descriptive statistics include all variables used in the supply chain in relation to socio-economic factors, infrastructure and the market and production process.

4.2.1 Demographic data of respondents

The demographic characteristics of small-scale poultry farmers are important indicators when analysing the sustainability of small-scale poultry production as well as its supply chain. In this section gender, age of poultry farmers, marital status and educational background are presented and discussed.

Figure 4.1 shows the gender distribution of respondents. There are slightly more males (51.43%) than females (48.57%) involved in poultry projects in the study area although Statistics South Africa (2012), reported that there are more women than men in South Africa. This high proportion of males to females may be due to the fact that generally, males are more productive in agricultural activities than females. The findings were similar to what other

researchers have discovered, whereby males are more involved in farming than females (Jatto, 2012; Sekoto & Oladele 2012 and Masuku, 2011).

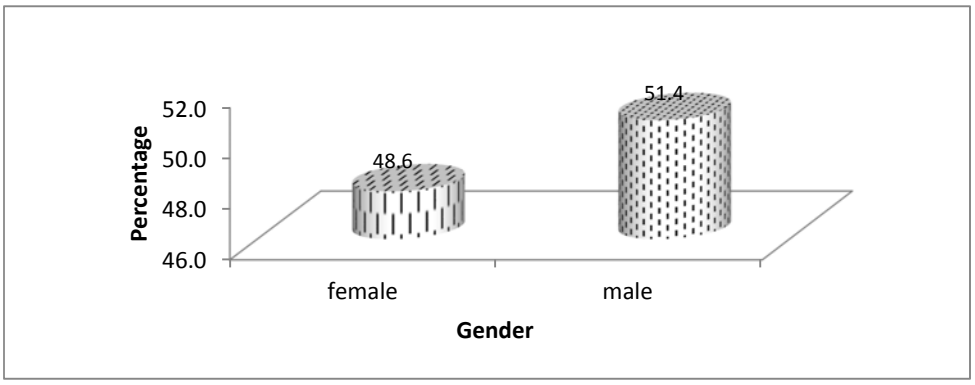

Figure 4.1: Gender distribution

The age group of farmers was classified using different categories (Figure 4.2). The results revealed that 41.43% of the respondents are in the age group of 46-60 years and the fewest respondents were within 20-30 years (7.14%). This indicates that fewer youth in RLM were actively involved in small-scale poultry farming. The small number of young people involved in poultry farming, would have an impact on skills transfer. Age indicates a position in the life cycle of a house-hold. The older age group tend to have more responsibility and bring stability to a household.

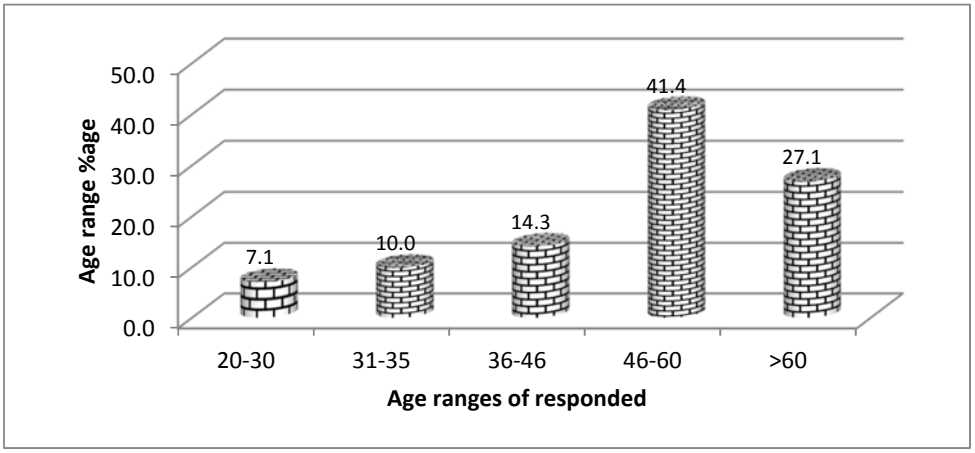

Figure 4.2: Age of respondents

The marital status of respondents was divided into four categories namely; single, married, divorced and widow/er. In the African context, marriage signifies stability. About 65.7 % of respondents were married and 2.9 % were divorced (Figure 4.3). This implies that most families involved in poultry farming in RLM were more stable and mature. This should have a positive effect on the sustainability of poultry projects.

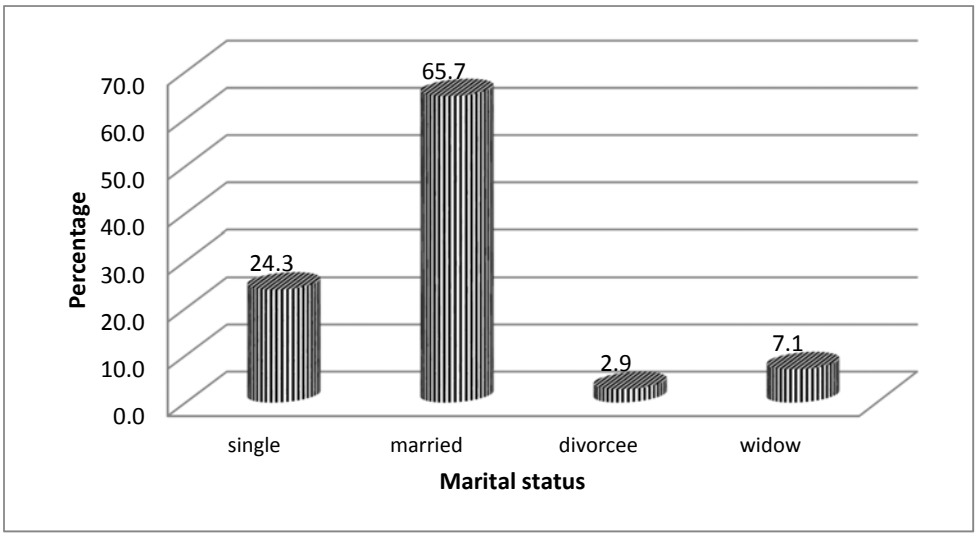

Figure 4.3: Marital status

Educational level of farmers determines the ability to interpret information and the human capital level of the household. It will further determine the rate at which farmers adopt new farming techniques. The results show that most sampled households had secondary education (54.3%) while those with tertiary and No-formal education were the lowest, with 8.6 % respectively (Figure 4.4). This implies that the majority of respondents were able to read and write. Figure 4.4 below summarises the educational background of sampled households.

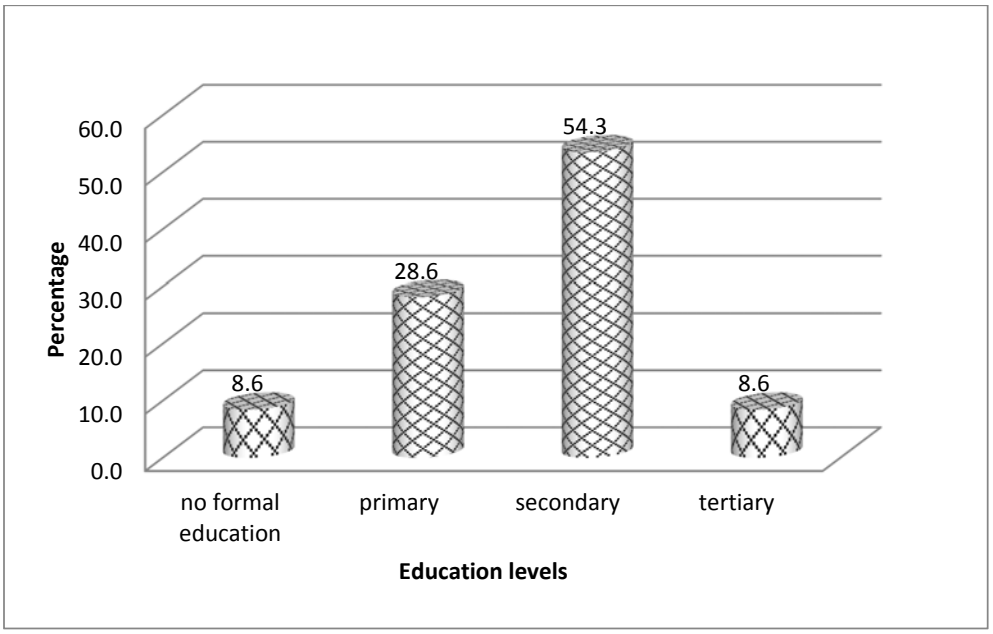

Figure 4.4: Education background

4.2.2 Socio-economic characteristics of respondents

The socio-economic characteristics of farmers are important so that one can have a better understanding of the respondents` livelihood. It also indicates household stability and vulnerability. The size of the farm in terms of the number of chickens in the farm, the current condition of the farm, experience of farmers, income and credit status of respondents were considered potential indicators of the socio-economic status of respondents. Table 4.2 summaries the socio-economic characteristics of small-scale poultry farmers in RLM. About 17.14% of farmers gained experience in poultry by working for commercial poultry farmers, while others gained experience from raising traditional poultry (44%). Experience can enhance production. Experienced farmers are less likely to make mistakes about their farming business compared to inexperienced farmers. The scale of small-scale poultry farmers in RLM is too small, 61.4 % of farmers had less than 200 birds per cycle. Lack of entry to formal markets can be one of the factors that lead to small capacity. Only 2.3 %% of the small-scale poultry farmers had more than 2000 chickens per cycle.

Furthermore, the results revealed the status of the poultry farm, whether the farm was still operating or not operating at the time of the survey. Only 52.9 % of projects were still operating,

5.7 % operated seasonally, mostly in summer; and 41.4 % were no longer operating. This implies that almost half of the projects were not sustainable. Between 5 and 6% of farmers reported to have taken a break due to the winter season (May and June). This group of farmers believed that in winter they experienced a higher mortality rate and most of their chickens grew slowly. The low level of poultry experience could have an implication on the management of resources. Farming experience promotes efficient use of scarce resources (Njoku & Odii, 1991).

Payment is an important motivating factor to workers or project beneficiaries. According to Table 4.1, 47.1 % of broiler farmers reported that they paid themselves after every broiler cycle. This could be between six and eight weeks. At the same time 14 % reported not having received monetary payment since they engaged or were employed on the poultry project. This implies that the projects are not improving the livelihoods of some beneficiaries. A number of farmers (17.1 %) reported that they used other payment methods not specifically appearing on the questionnaire. Only 2.9 % of small-scale poultry projects had access to purchase production input (DOC or feed) on credit, 97.1 % reported not having been able to access credit. Aliber & Hall (2012) reported similar findings. The outcome clearly indicates that the majority of small-scale poultry farmers in RLM are not creditworthy.

Table 4.1: Socio-economic characteristics of respondents

Experience	**Frequency**	**Valid %age**	**Cumulative %age**
Size of farm			
<200 birds	43	61.4	61.4
200-500 birds	18	25.7	87.1
500-1000 birds	4	5.7	92.9
1000-2000 birds	2	2.9	95.7
2000-5000 birds	3	4.3	100.0
Current status			
Operating	37	52.9	52.9
Not operating	29	41.4	94.3
Seasonal	4	5.7	100
Farming experience			
Commercial	12	17.1	17.1

Village poultry	27	38.6	55.7
No experience	31	44.3	100.0
Payments			
Once a year	5	7.1	7.1
Every broiler cycle	33	47.1	54.3
Every month	2	2.9	57.1
Every three months	4	5.7	62.9
Every six months	4	5.7	68.6
No payment	10	14.3	82.9
Other (no respond)	12	17.1	100.0
Credit availability			
Yes credit available	2	2.9	2.9
No credit	68	97.1	100.0
Income after sale ®			
<2000	10	14.3	14.3
2001-4000	13	18.6	32.9
4001-6000	22	31.4	64.3
6001-8000	9	12.9	77.1
8001-10000	8	11.4	88.6
>10001	8	11.4	100.0
Farm transport			
vehicle	31	44.3	44.3
truck	2	2.9	47.1
public transport	17	24.3	71.4
hire	17	24.3	95.7
donkey cart	3	4.3	100.0

Income after sale is a good measurement to see if a farm is making a profit. The profitability of the business is tested. When the total expenditure is deducted from net income. Due to confidential consideration, the exact income was not asked during data collection, the questionnaire structured income after sales into six categories. The farmers making turnover of below R2000 were 14.3 % and those above 2001 and below 4000 were 18.6 % per cycle. Those making above 10000 were 11.4 %. The level of income was strongly associated with the size of the farm. The lower income was aligned to the size of the farm to determine factors that had a negative effect on the sustainability of the enterprise.

In the farming business, vehicles are used for many different reasons in the supply chain, such as transporting production inputs to the farm, delivering outputs to the market. The results of the survey show that 44.3 % of respondents used their own vehicles for farming activities such as buying consumables, marketing produce or anything related to farm activity. The greater number of farmers in the study area has different transport mechanism. This helps to facilitate the core functions of the business. About 24.3 % of farmers relied on public transport.

To start a project one needs capital and resources. Most poultry projects are self-funded while some are funded by government agencies. Figure 4.5 displays a number of projects funded by government Agencies (32.9%) and those that are self-funded. It is common in most parts of South Africa that the majority of small-scale poultry projects are funded by the project founder (65.7%). This reflects the underlying capital shortage and corresponding need to improve access to credit. The results agree with the findings of Ike & Ugwumbu (2011).

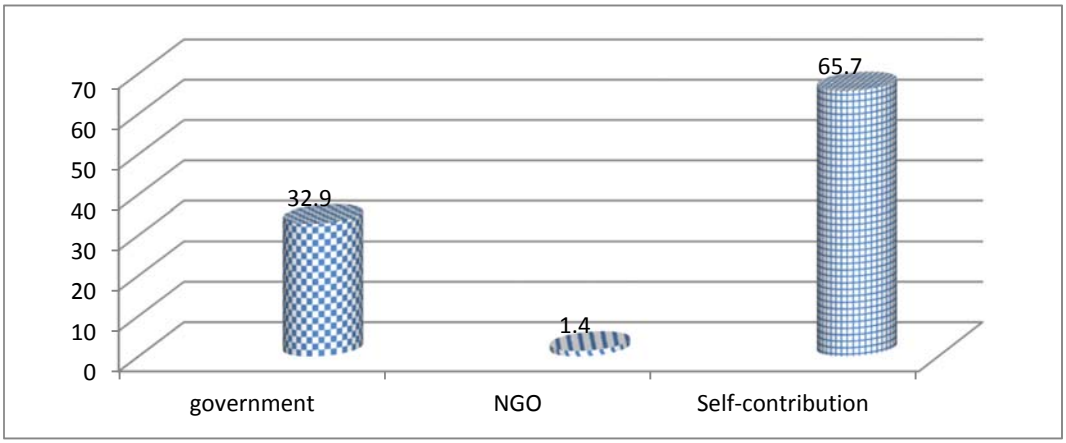

Figure 4.5: Source of funding

The Department of Social Development has funded a sizeable number of poultry projects in RLM, more than the Department of Agriculture (Figure 4.6). The Department of Agriculture (Provincial or National) only funded 14.3 % of projects. Most of the projects were funded by the self-contribution method (65.71%). The RLM Local Economic Development, contributed 2.8 % while one project was funded by a private investor. The lack of access to funding could have a negative effect on the sustainability of these projects. Without access to capital projects will not scale, they will remain small. This could have a serious impact on the sustainability of these projects.

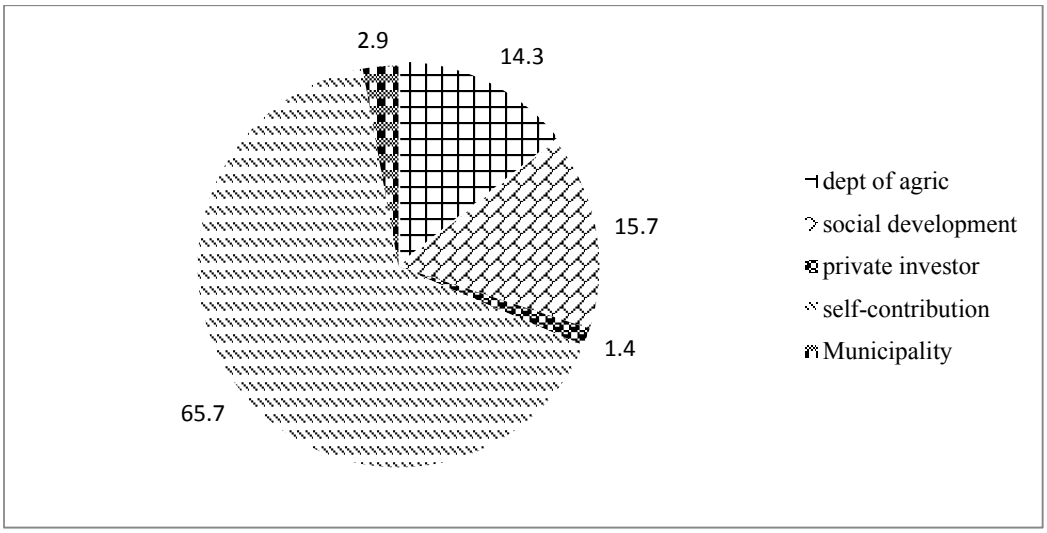

Figure 4.6: The funders of the project

4.2.3 Rewards for Beneficiaries

Rewards are an important motivating factor to workers or members of the project. Beneficiaries can be rewarded by means of monetary or in-kind / products of the project, monthly, seasonally or per production cycle. The majority of respondents received both monetary and in-kind payments. Of all the participants, only 11.4 % reported having not received payment because the project was not making enough money to pay salaries. All the money that they made was reinvested in the project by buying production inputs. The in-kind payment received was in the form of eggs or matured broilers. Table 4.2 summaries the type of payments that the small-scale poultry farmers received from their respective projects.

Figure 4.7 indicates the amount of payment farmers received. The greater number (64.2%) of small-scale poultry projects owners or employees were earning less than R500 per month. This implies that small-scale poultry farming enterprises in RLM are not a lucrative business venture.

Table 4.2: Payment method

Type of payment	Frequency	Valid %age	Cumulative %age
Monetary payment	21	30.0	30.0
Kind payment	3	4.3	34.3
Both monetary & kind	37	52.9	87.1
No payment	8	11.4	98.6
Other payment method	1	1.4	100.0
Total	70	100.0	

Figure 4.7 shows that majority of projects beneficiaries or owners are getting less than the minimum wage (R2274.82) for farm workers initiated by South African Government in 2013.

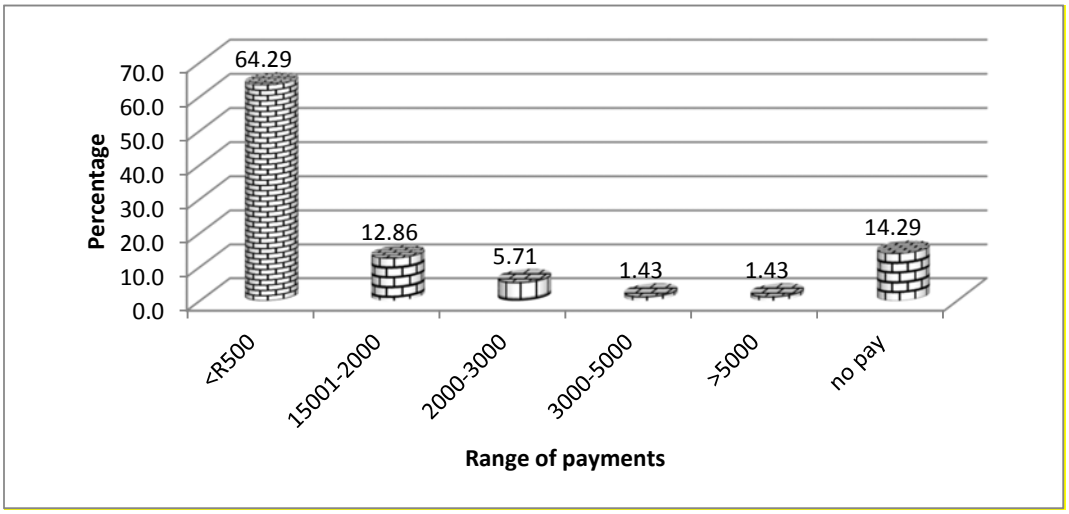

Figure 4.7: Payment levels of poultry farmers in RLM

An amount of R1500 is below a living wage; however, this does not include the kind payment received by members or respondents. If farmers were able to draft business plans they would have estimated a projected monthly salary before committing their time and money on these projects.

4.2.4 Location and description of the poultry projects

The RLM has 14 wards with more than 26 villages. It has no town or city, as it is a rural municipality. This implies that farmers are located in remote villages where there are no formal markets such as big retails; and no or low access to service infrastructure. Poultry projects within these villages are either initiated by Government agencies or members of the community so that they can sustain their livelihoods. Ward six and twelve had disproportionate broiler projects. Ward four had the maximum, number of layer projects. Nonetheless most of them were initiated by the government. The greater number of these projects (layers) were not operating. Figure 4.8 presents the frequency distribution of poultry projects per ward in RLM.

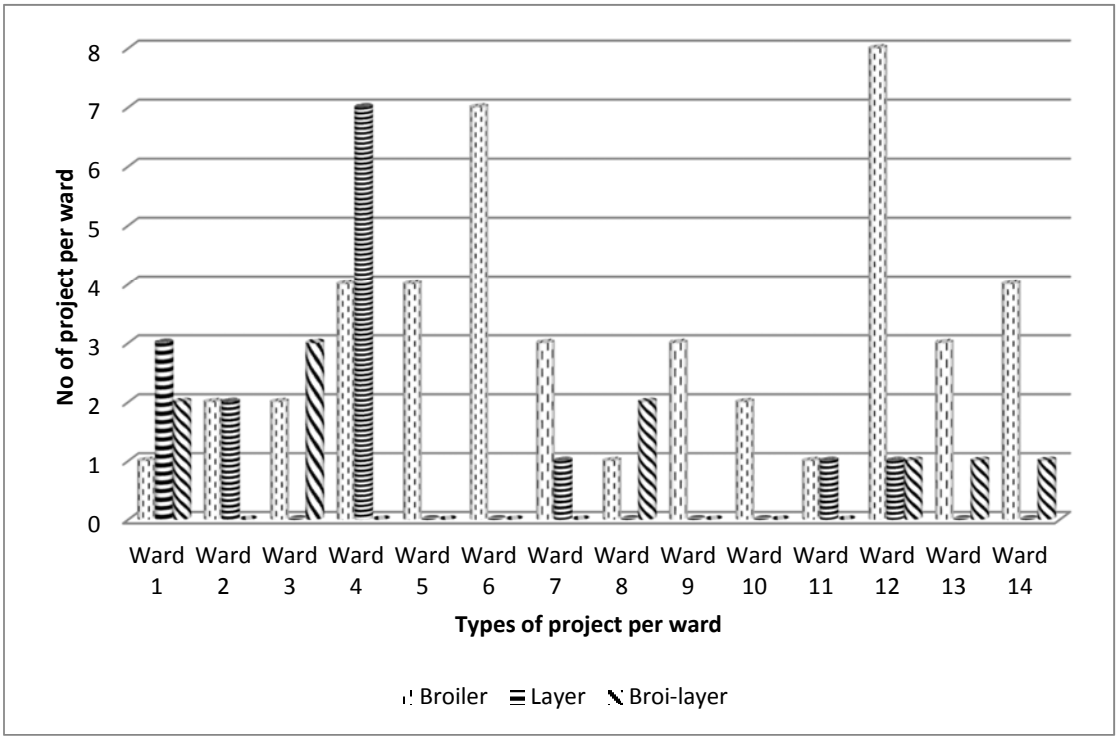

Figure 4.8: Poultry projects per Wards in RLM

Table 4.3 presents the frequency distribution of poultry projects in RLM. Farming activity, type of poultry house and type of feed storage are summarised. These factors clarify the condition of broiler and layer houses in RLM. This information is critical when one needs to understand the number of broiler and layer houses, the conditions of feed storage facilities and the conditions of broiler and layer houses in RLM.

Table 4.3: Description of different variables for Small-scale poultry projects in RLM

Description of poultry projects	Frequency	Valid %	Cumulative %
Farming Activity			
Broiler	45	64.3	64.3
Layer	15	21.4	85.7
Broiler & layer	10	14.3	100.0
Indigenous	0	0	
Types of poultry house			
Open-sided house	29	41.4	41.4
Poultry shack	22	31.4	72.9
Old brick house	13	18.6	91.4
Organised material	6	8.6	100.0
Poultry feed storage facility			
Farm store	19	27.1	27.1
Inside poultry house	29	41.5	68.6
Inside owners house	22	31.4	100.0

The information presented in the Table 4.3 shows more broiler (64.3%) than layer Projects (21.4%). This could mean that farmers find broilers more lucrative than layers or could mean that there are limited suppliers of layer hens available in RLM. On the contrary, Ahmed *et al*. (2011), had discovered that there are more egg small-scale farmers in Kano state Nigeria. Broilers and layers need to be kept in structures that will protect the birds from harsh weather conditions and predators. Environmental factors could influence the production output. None of the small-scale poultry projects in RLM used a climate controlled poultry house. The standard open-sided house represents 41.4 % and unqualified shack building 31.4 %. Broilers and layers housed in environmentally controlled poultry house are less affected by the external weather. Aganga *et al*. (2000) also revealed that smallholder farmers in Botswana use concrete and corrugated iron sheet to construct the broiler houses to protect against harsh external

environment. The pictures of poultry houses that are functional and non-functional are presented in Appendix 3.

Poultry feed is the most expensive poultry production input. It needs to be managed and stored properly in a suitable environment. However, 41.5 % of smallholder poultry farmers in RLM stored poultry feed inside the poultry house, while 31.4 % stored feed inside the farmers' house and 27.1 % inside the farm store. Poultry feed stored in too high or low relative humidity for a long period could lose nutritive value and affect the growth rate of broilers or production of eggs. This could eventually have a negative impact on the sustainability of the project because chickens will be taking long to reach the market age and fewer eggs will be produced.

4.2.5 Operational management implemented in projects.

Poultry farmers, whether small or big, need to adhere to basic principles of management, such as record keeping, staff management and cleaning of the poultry house. Workers are primarily employed to perform these duties. The efficiency of a team can be measured by how the group works together. Figure 4.9 shows the distribution of the status of people who performed daily routine in their respective projects. In most cases the owner worked alone or with an assistant.

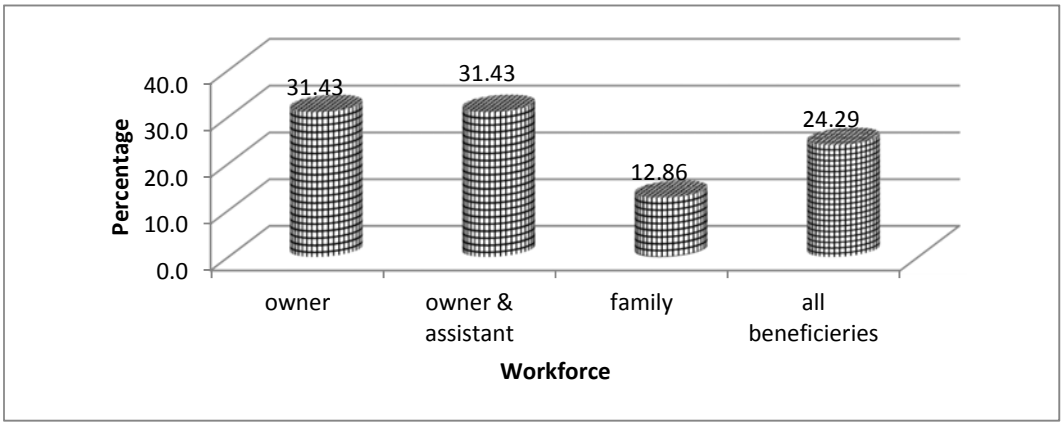

Figure 4.9: Daily routine of workers

According to Figure 4.10 Small-scale poultry farmers in RLM do not have a structured method they adhere to. When it comes to rotating staff to perform daily activities. The majority of workers reported an unpredictable work plan. This implies lack of consistency and untested

management style. Inconsistency and poor management aspects could be some of the factors that affect the sustainability of small-scale projects.

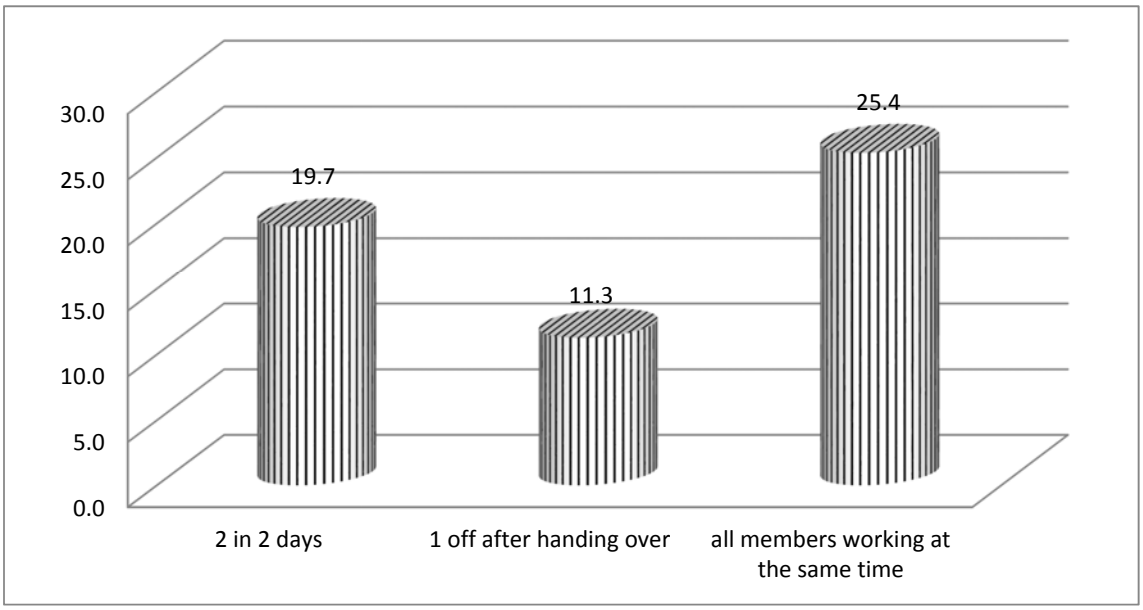

Figure 4.10: Applied weekly working schedule

Record keeping is an important management function for t every business. To keep detailed and accurate records is an essential skill that every farmer needs. Daily records include mortality, the number of eggs produced, and a list of customers who bought broilers or eggs on credit or cash and the people that visited the farm. Monthly records include sales income spreadsheet, a summary of mortality and other management aspects of the farm. Under monthly record keeping, a cleaning roster or daily routine duties should be drafted for the following month. Figure 4.11 shows that 58.7 % of farmers did not keep records on daily and monthly basis.

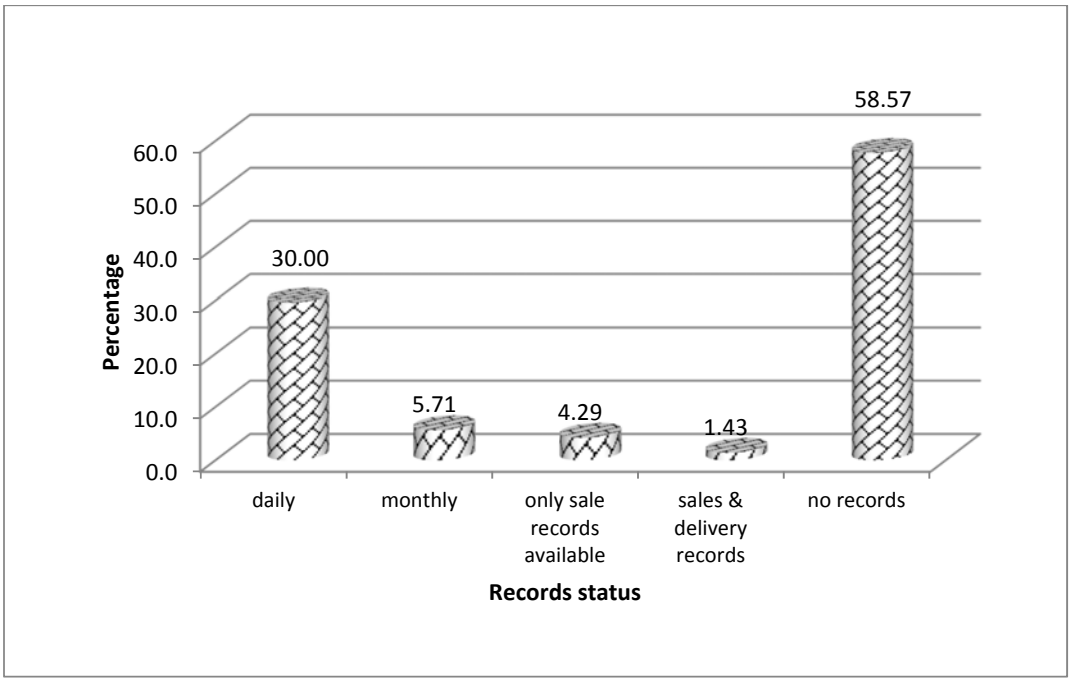

Figure 4.11: Records Management

An immense number of small-scale poultry farmers in RLM did not keep annual records (88.57%). This shows poor business management skills. Annual production records are essential data that can be used to develop a business plan. This could also be used for tax purposes. The findings support the results of Aganga *et al*. (2000) that small-scale farmers do not keep proper records. However, contradictory results were reported by Tham-Agyekam, Appiah & Nimon (2010) that in Ghana, Ga-East municipality whereby almost all poultry farmers keep production and financial records. Most agricultural projects started by the community or initiated by the government as part of rural development do not last long due to lack of management skills and other factors. These findings support Teguia & Beynen (2004) where small-scale broiler production in Cameroon is characterized by poor efficiency of feed utilisation, poor growth, inadequate management skill of farmers and high mortality seems to be some of the main challenges in the small-scale poultry sector.

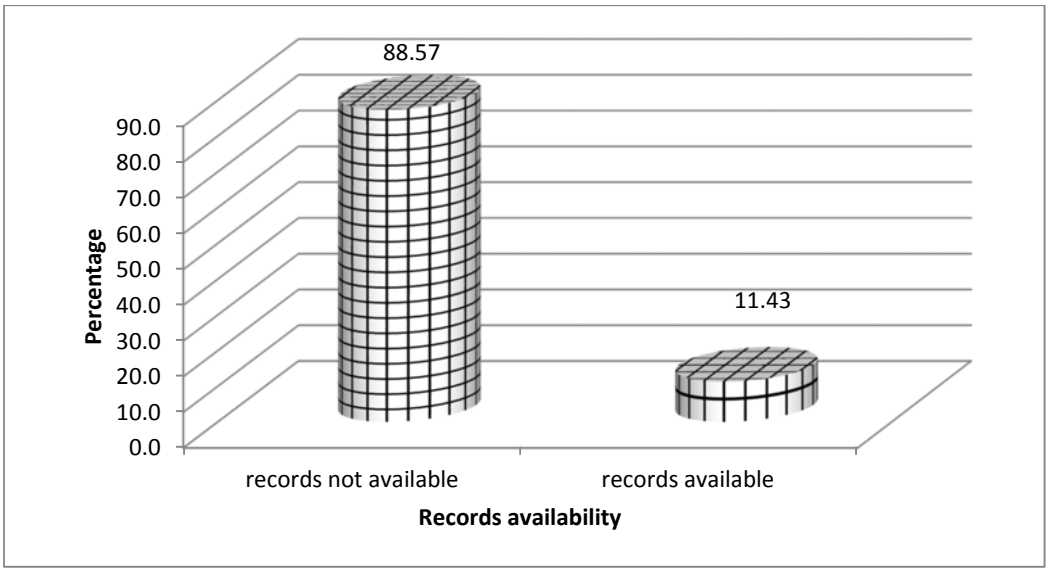

Figure 4.12: Annual production records

A farm business plan helps a farmer to articulate their business intentions accurately and confidently. It is an important management document used by different funding agencies to assess the viability of every business before allocating or committing funds to the project. Table 4.4 shows that few (14.3%) small-scale poultry farmers in RLM have business plans. This suggests that most households have not formalised their business. The findings are consistent with those of Kettering (2002) who states that business plan is the most important document for any business. This suggests that most households have not formalised their business. They will find it challenging to convince most funding agencies to invest in their business. This could be the reason why most of these projects are self-funded.

Table 4.4: Business plan available

Business plan	**Frequency**	**%age**	**Valid %age**	**Cumulative %age**
Available	10	14.3	14.3	14.3
Not available	60	85.7	85.7	100.0
Total	70	100.0	100.0	

4.2.6. Knowledge, skills and experience

knowledgeable and skillful workers can play a critical role to help the business to succeed. It is important for poultry farmers to know the breed they use on their respective farms. To test the basic knowledge of poultry farmers in RLM, farmers were asked to name the poultry breed they are using on their farms. The greater number of farmers (91.4%) did not know the breed they were using. If farmers have knowledge about the breeds they would be able to make an informed decision, address production challenges related to breeds behavioural characteristics. Some farmers reported that some of their laying hens were pecking on other chickens and this leads to other hens reduced eating and this resulted in a decrease in egg production. Lack of knowledge on how to address farm-related problems can decrease farm productivity and affect sustainability. The study supports the results of David & Asamoah (2011) that suggests that improved knowledge is likely to translate into improved practice. Training in business management is critical in ensuring that farmers meet the standards and grades of the markets (Louw *et al*., 2007). The results are presented in Table 4.5.

Table 4.5: Farmer knowledge test

Name of the breed	Frequency	%age	Valid %age	Cumulative %age
Cobb 500 "know"	3	4.3	4.3	4.3
Ross "Know"	3	4.3	4.3	8.6
Don't know	64	91.4	91.4	100.0
Total	70	100.0	100.0	

Extension service is one of the institutions set up by the government to bridge the knowledge gap between farmers and agricultural research. Extension officers are responsible for providing farmers with technical information through individual or group farmer training or workshop. Figure 4.13 shows whether the small-scale poultry farmers had access to extension services or not, 85.71% of farmers reported having not been trained or engaged with extension officers on matters relating to their poultry projects. Only 5.7% of farmers reported having had regular discussions with their extension officers, while 8.57% admitted they seldom get information from extension officers.

Department of Agriculture offices are available in villages within RLM. Villages such as Dingateng, Mabule (Ward 01), Moshawane, logageng, Matloding (ward 04) Madibogo-Pan,

Diolwane (Ward 07), and Thutlwane/Setlhwatlhwe (Ward 13) had no agricultural offices for Extension Officers. This implies that farmers had to make a call or travel to other villages to access the services of Extension Officers. Even though Extension Officers were mobile, could move from one village to the other, they have offices in certain villages for their administrative activities. The results reveal that 5.71% of small-scale poultry farmers in RLM had access to regular service from extension officers. The results are in agreement with the findings of Cunguara & Moder (2011) that extension officers only target few farmers.

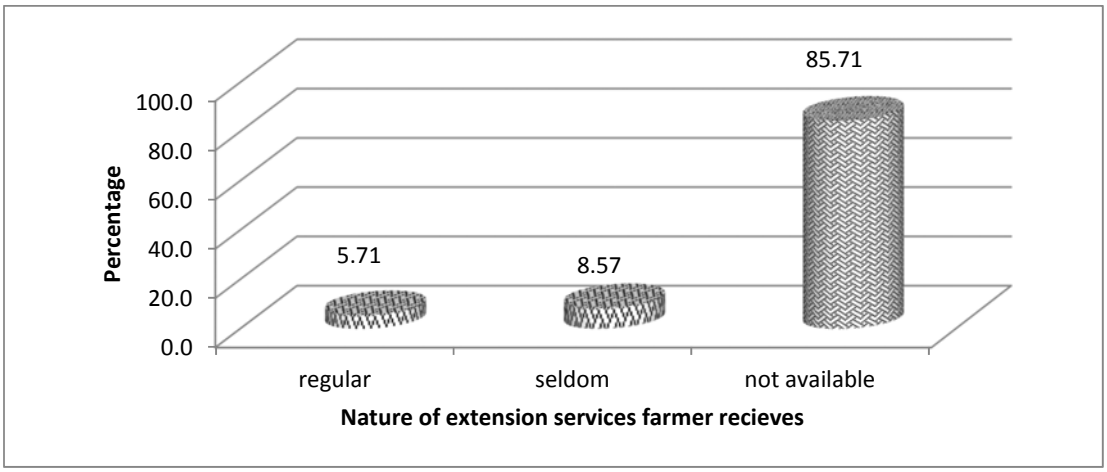

Figure 4.13: Extension service

Figure 4.14 shows that a large number of small-scale poultry farmers in RLM acquired farming skills through self-training (51.4%). This shows the lack of efficient extension service training in RLM. Only 1.4 % of farmers attended agriclutural science training college. This is a low number considering the fact that South African government have made bursaries available for people who are interested in attending further education training colleges (FET). The number of farmers who attained skills by attending Sector Education Training Authority (SETA) is very low (21.4%) considering the investment that the South African government has made on this type of vocational training. This could suggest that farmers do not have access to information or they are too commited to other aspects of their life or they are not interested in attending agricultural training programmes offered by extension officers.

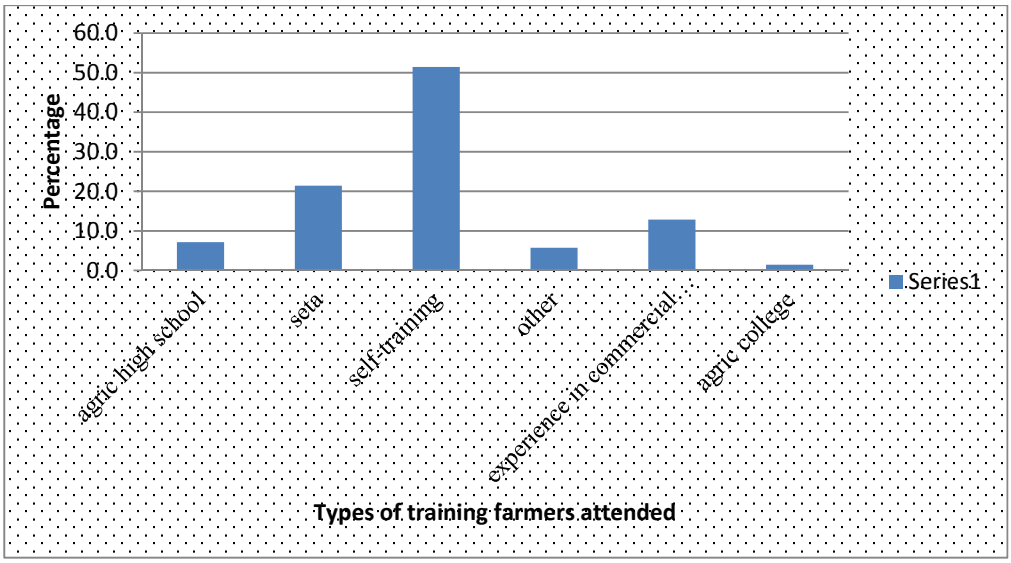

Figure 4.14: Types of training farmers acquired to develop their skill

4.2.7 Sales and marketing of project products

Marketing of the production output is an essential compartment in the supply chain. To market poultry products, particularly for small-scale poultry farmers, is challenging. Small-scale poultry farmers by the nature of their business are informal. Their products are likely to be targeted at informal markets. It could be vendors or neighbouring communities. A sales calendar is a crucial marketing tool that plays an important role in the operations management of the business. Figure 4.15 presents a number of farmers with or without a sales calendar. The greater part of farmers (71.4%) did not have a sales calendar; this implies that their production was not planned. In most rural villages in South Africa, the money circulates more often during the government grants pay-days. If farmers were planning their production (broilers in particular) according to the government grants pay date for massive sales, they would link the readiness of products to grant pay-dates. This could minimise production losses because grant beneficiaries would buy chickens that are ready for marketing. This could benefit the farmer in many ways, by reducing the feed and management expenses. They would make sure their broilers were ready for the market on those particular dates. This could help them to spend less money on feeding ready-to-sell chickens. This small exercise could improve the sustainability of most of these projects.

Figure 4.15: Planned production sales calendar of poultry farmers in RLM

Marketing of ready-to-sell chicken is a challenging task, particularly for farmers who do not have reliable or formal markets. In commercial broiler farms, chickens are ready to sell when they are five weeks old. However, in RLM, the majority of broiler farmers (62.86%) reported that their chickens are ready to market after six weeks, 4.29 % indicated that chickens take up to eight weeks before they are ready to market. This implies that farmers used more feed to get chickens ready to market. It also increases the transaction cost, it could also have a negative impact on the sustainability of these projects. Taking eight weeks to raise a broiler could also decrease the number of production cycles per year. Similar findings reported by Masuku (2011) that in Swaziland birds produced by small-scale farmers' system of production mature from five to eight weeks. To shorten broiler production cycle from six to five weeks, farmers must have effective markets and adhere to principles of broiler production management.

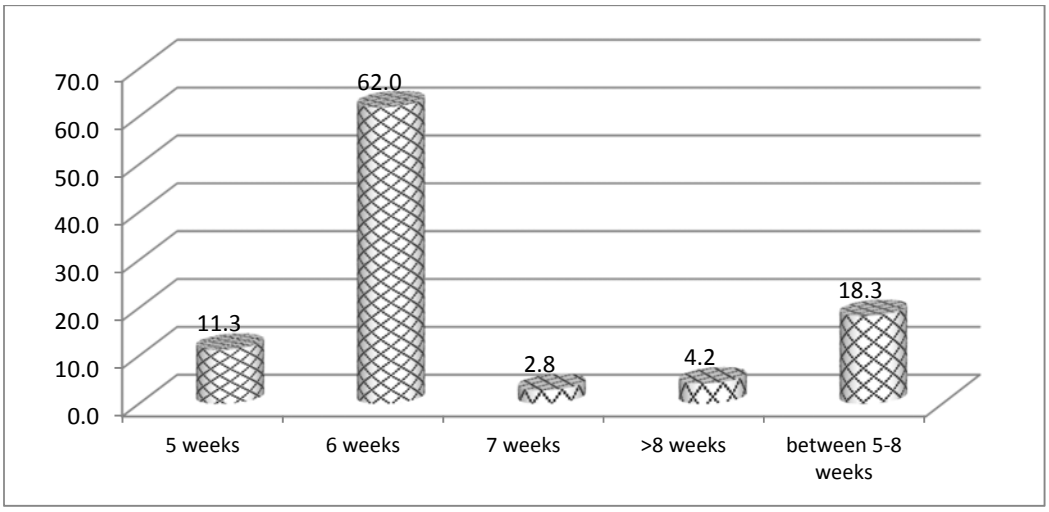

Figure 4.16: Broiler marketing age in RLM

The sales duration of ready to sell broilers is another critical factor that can determine the sustainability of the business. In RLM, broiler farmers (37.17%) reported that they took two weeks to sell all their stock. Farmers had to continously feed chickens that were already marketable . This can result in decreasing profit margins in the enterprise and lead of farmers took four weeks to sell all their chickens. This could suggest that these farmers lacked marketing skills. Marketing skill plays a crucial role in the supply chain of any business, without this critical skill most farms become unsustainable, because farmers will be producing products do not have buyers for their production outputs.

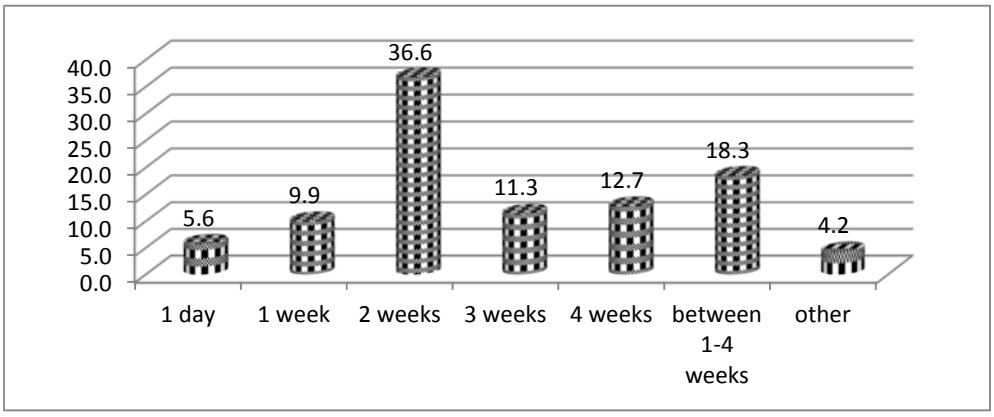

Figure 4.17: Broiler sales duration

4.2.7.1 The estimated gain or loss in Rand for two larger group categories of farmers

Two categories below show the actual loss that might be encountered by farmers according to the sizes of their farm.

Formula:

Step 1: No. of farmers x No of chickens in the farm x % of farmers in that category

Step 2: Answer from step 1 x feed intake x duration of sales after for ready product = Accumulative feed

Step 3: Answer from step 2 (accumulative feed) x feed cost per kg = Total accumulative cost of sales for a ready to sell product

Category A < 200 chickens

Step 1 = 45 farmers x 200 chickens x 61.4% (0.614) = 5 526 chickens

Step 2 = 5 526 chickens x 2.1 kg feed in 14 days = 11 604.6 kg

Step 3 = 11 604.6 kg x R6.20 = R 71 948.52

The extra loss the can be occurred by farmer who fed chickens for an extra 14 days works out to; (R 71 948.52 / 45 farmers in 200 category) = R1 598.86

Category B 201 – 500 (350 chickens)

Step 1 = 45 farmers x 350 chickens x 25.7% (0.257) = 4047.75 chickens

Step 2 = 4 047.75 chickens x 1.05 kg fed for 7 days = 4250 kg of feed

Step 3 = 4 250 kg x R6.20 = R26 350.00

The calculation of the two categories above, reveals that the farmers who farm with 200 chickens each could lose R 1 598.86 per cycle if the project had to feed chickens for an extra 14 days. The further calculation reveals that each project would lose an extra R6.50 per chicken in seven days and R13.00 per chicken in 14 days, which may be the unrecovered cost (loss). Under normal circumstance, the profit margin for broilers in commercial farming is

approximately R2.00 to R3. 50. This calculation clearly illustrate why most small-scale poultry farmers fail to operate sustainably because the extra costs that they encounter are approximately 80% higher than expected profit per chicken.

The sales duration of eggs also has an effect on the profitability of the organisation. Eggs have a shelf life, even with continued refrigeration. Figure 4.18 shows the sales method applied by different poultry farmers in RLM. Most of the layer farmers did not know the duration of sales after the egg had been laid.

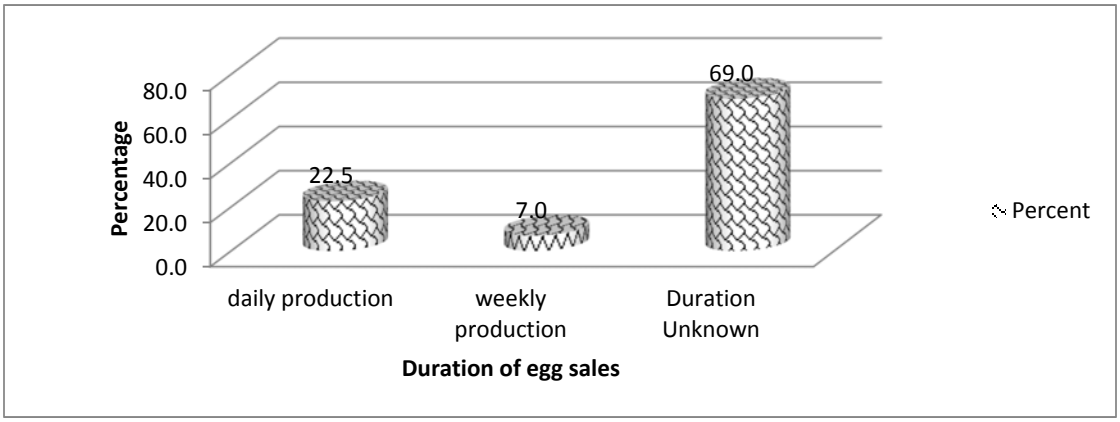

Figure 4.18: Sales duration of eggs

Eggs in community poultry projects are either sold on a daily or weekly basis. Figure 4.19 shows that the majority of respondents (71.43%) sold eggs on a daily and weekly basis. At the same time, 22.9 % of farmers only sold eggs on a daily basis. The duration of egg storage can have an effect on the transaction cost by increasing the production costs such as energy during the refrigeration period.

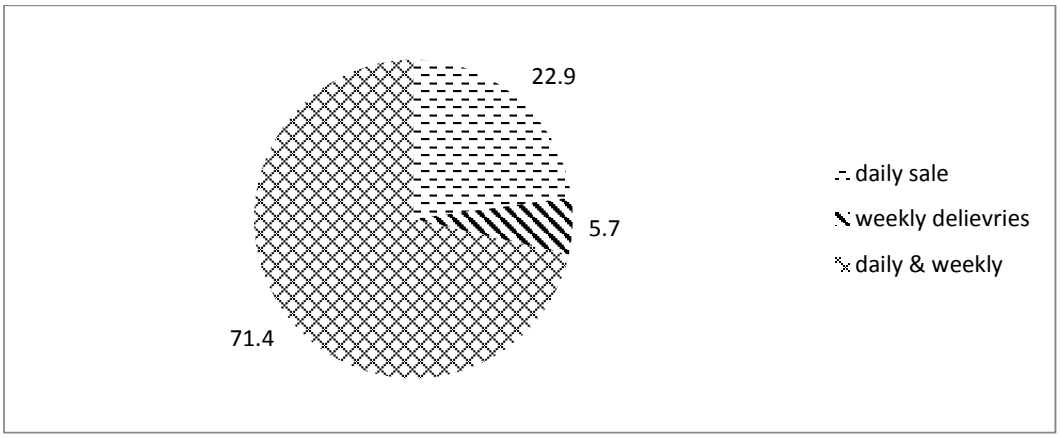

Figure 4.19: Egg sale schedule

4.2.7.2 Market

Table 4.6 illustrates that none of the small-scale farmers had access to proper market stalls to sell their chickens or eggs. Only informal market stalls, which are temporary in nature were available. The results agree with the findings of Aganga *et al.* (2000) and Delgado (1999) that small-scale farmers have unstable marketing arrangements. The lack of formal market stalls could show inconsistency in farm produce marketing activity. Lack of market stalls could also suggest that farmers only rely on customers coming to their farms to buy eggs or chickens. This could suggest that small-scale farmers do not understand the value of having a permanent formal marketing stalls that could be used to sell their produce, since these are not available in their supply chain.

Table 4.6: Poultry market stalls availability in RLM (N=70)

Poultry market stalls	**Frequency**	**%age**	**Valid %age**	**Cumulative %age**
Not available	70	100.0	100.0	100.0
Available	0	0	0	

In most communities, only tuck-shops were available with a few supermarkets but no malls. Due to the lack of formal markets, the majority of small-scale farmers had to sell their produce

in their communities or directly at their farms. Without formal markets it could be very challenging for these projects to be sustainable. Their life span could also be short.

4.2.7.3 Central market

None of the wards in RLM had a central market for sales of chickens and eggs, buyers had to physically come to the farm to buy the produce. The farmers had to drive around the village to sell their farm produce. Figure 4.20 shows the lack of central market of farmers in all wards that surrounded RLM. In nearby town of Mahikeng, farmers have access to a small-scale farmers market that was built by the government, Department of Agriculture.

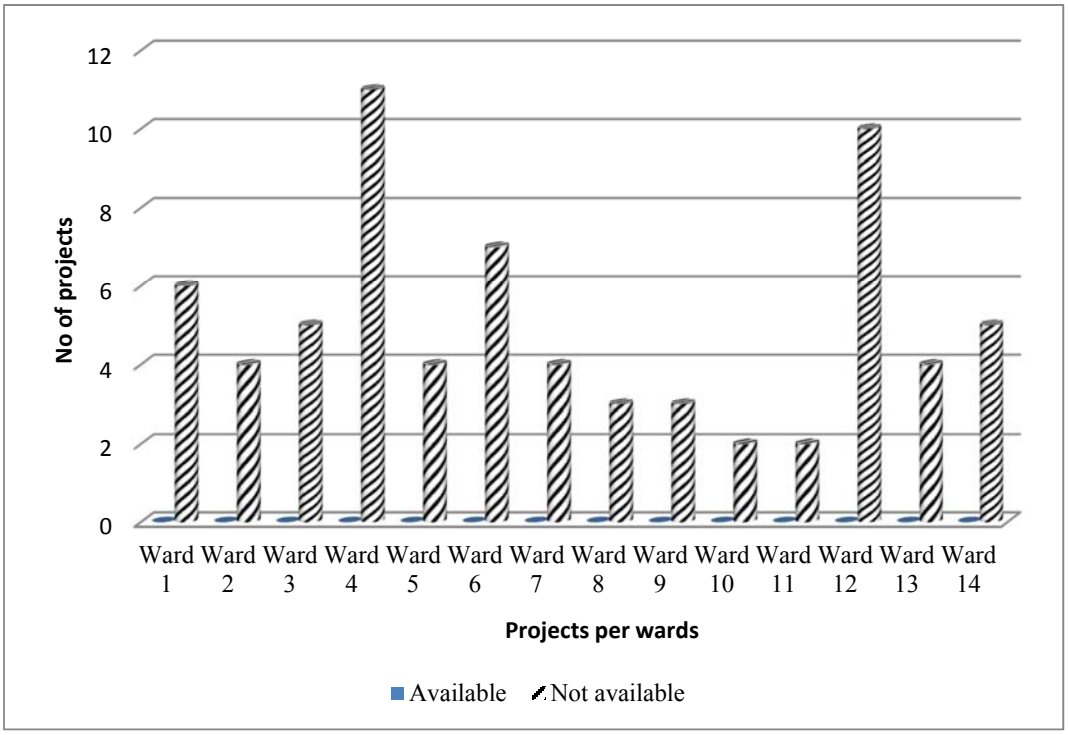

Figure 4.20: Availability of poultry markets per Ward in RLM.

According to Table 4.7, 90 % of the products (chickens and eggs) produced by small-scale poultry farmers in RLM were sold to community members. While only 1.4 % were sold to supermarkets. Only one farmer reported to have supplied the local supermarkets with eggs. The lack of structure or central market is a serious challenge for most small-scale farmers in Africa.

Table 4.7: Target market

Target market	Frequency	%age	Valid %age	Cumulative %age
Community	63	90.0	90.0	90.0
Community & tuck shop	2	2.9	2.9	92.9
Community & hawkers	4	5.7	5.7	98.6
Super-market	1	1.4	1.4	100.0
Total	70	100.0	100.0	

The supply chain is not complete unless the product reaches the clientele, the results of the survey show that 87.1 % of farmers travelled less than five km to marketplaces or customers. The short travelling distance could be influenced by the lack of marketing transport, unavailability of reliable markets or poor conditions of the roads. The availability and conditions of the roads determine accessibility of markets. Only three farmers reported to have travelled more than 20 km to reach other markets which were not in their community. Table 4.8 summaries the distance farmers travelled to reach markets.

Table 4.8: Distance travel by farmers to the market

Distance to the market (Km)	Frequency	%age	Valid %age	Cumulative %age
<5km	61	87.1	87.1	87.1
5-10km	3	4.3	4.3	91.4
10-20km	3	4.3	4.3	95.7
>20km	3	4.3	4.3	100.0
Total	70	100.0	100.0	

4.2.8 Suppliers of production inputs in the supply chain

There are many different suppliers of day-old chicks (DOC) in South Africa. Most farmers prefer hatcheries that provide chicks with low mortality rate and healthy growing chicks. These traits and characteristics are the specific ones farmers look for when they purchase their day old chicks. Based on the information presented in Figure 4.21, 45.7 % of small-scale farmers in RLM sourced their chicks in other towns such as Pretoria, Lichtenburg or Potchefstroom. Similar findings reported by Fernandez (2012) that many hatcheries still travel more than 100 km to deliver chicks to broiler farms. Long travelling distance causes stress on chick and it can affect their performance. The effect of long travel could be one of the factors some farmers take eight weeks before their chickens are ready for the markets.

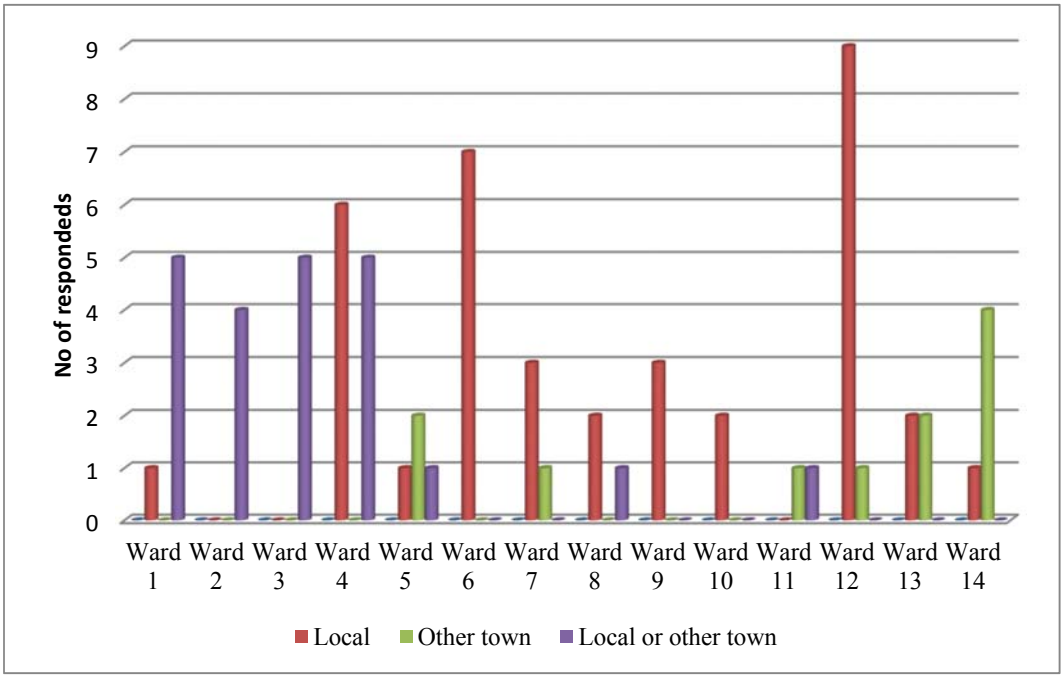

Figure 4.21: Day old chick supplier/place source

Availability and delivery of chicks to the farm are some of the factors that can determine the sustainability of the poultry project. Figure 4.22 shows that 58 % of small-scale broiler farmers

in RLM had to place an order before chicks could be made available for them, while 14 % reported that chicks are always available from their supplier. Whether the chicks are available at local cooperatives or outside the town, transport is still needed in order to facilitate the delivery between hatchery and broiler farm.

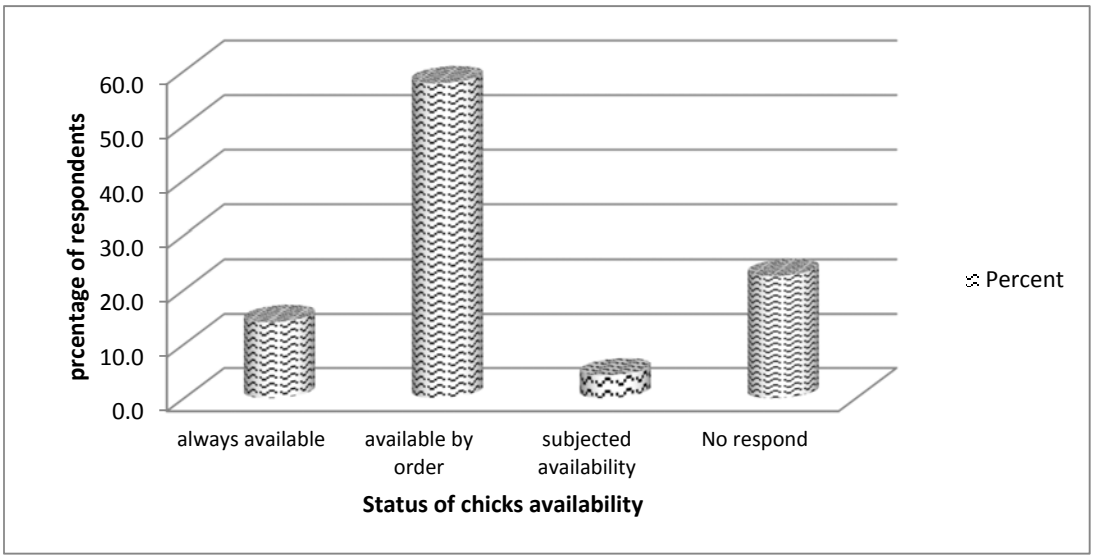

Figure 4.22 Day old chick availability

Figure 4.23 shows the mechanism that was used to deliver the DOC to the farm. Twenty % of farmers indicated that chicks are delivered by the supplier. However, farmers still need to travel to the delivery station to fetch their delivered stock. Based on the information presented in Figure 4.23, only 21 % of farmers used their own transport to collect DOC. This implies that majority of the farmers had to use public transport (8.57%) or hire a vehicle (10%). This could further discourage farmers from continuing with their project thus leading to a negative effect on the sustainability of these projects.

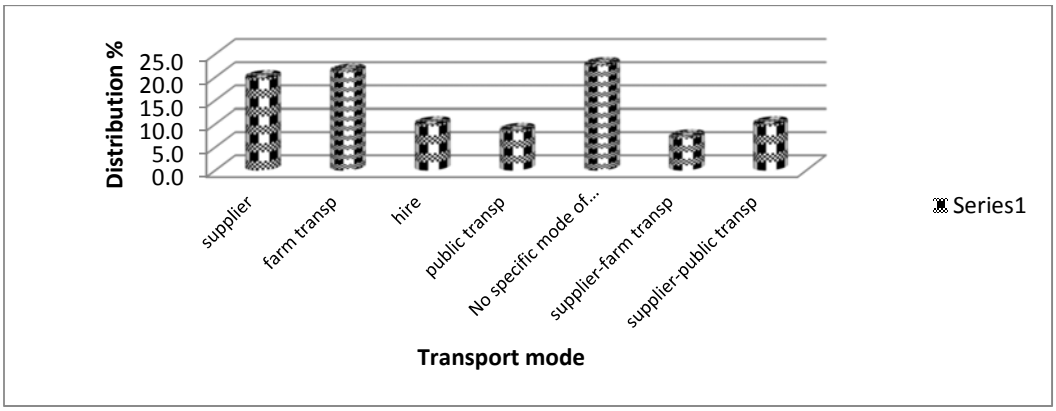

Figure 4.23: Day old chick delivery to the farm

Feed is one of the most important and expensive poultry production inputs. The area where farmers buy their production input and the feed quality is one of the essential managerial decisions that farmers must be able to make. Figure 4.24 shows that poultry farmers in RLM sourced their feed at local cooperatives or towns. The majority of small-scale poultry farmers in Ward 12 sourced their feed at the local cooperative. The farmers at Ward 11 purchased chicken feed at other towns because the feed was not available at their local cooperatives or shops. This implied that they had to incur additional spending on transport. It could increase the transaction cost which means farmers would also adjust the price which could make them lose customers based on the price increase.

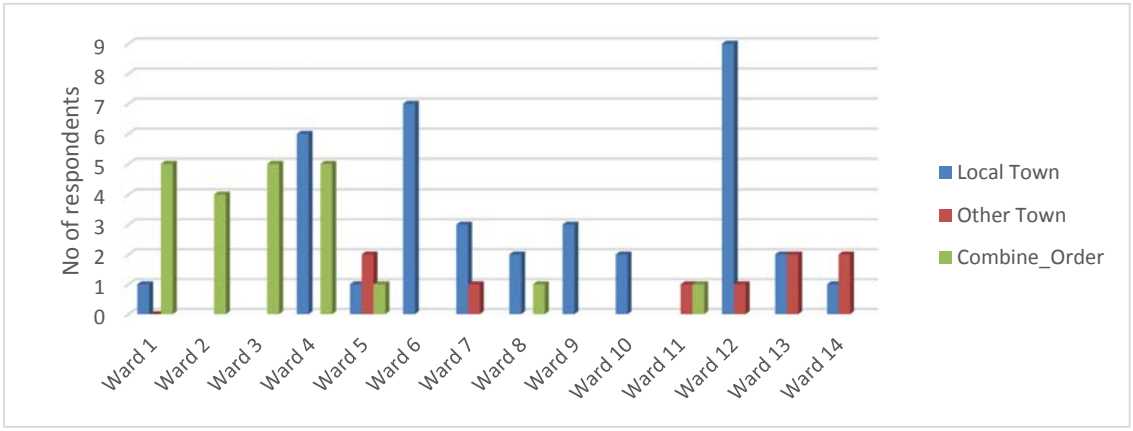

Figure 4.24 Poultry feed supplier

Some farmers particularly in Ward 4 which includes villages such as Moshawane, Logageng and Matloding, had to buy their feeds in Mahikeng, which is more than 100km distant. To

enable small poultry projects to be sustainable, production inputs should at least be available at their local cooperative. This could be one of the reasons most layer chicken projects that were funded by government Agencies in Ward 4 had to be discontinued. Lack of local suppliers would have a negative effect on the sustainability of a poultry project. The lack of properly balanced feed for chickens affects their productivity. Feed availability and delivery to the farm is one critical factor to consider. According to Figure 4.25, 98 % of farmers reported that feed was always available at their local store, whether at local cooperative or another town.

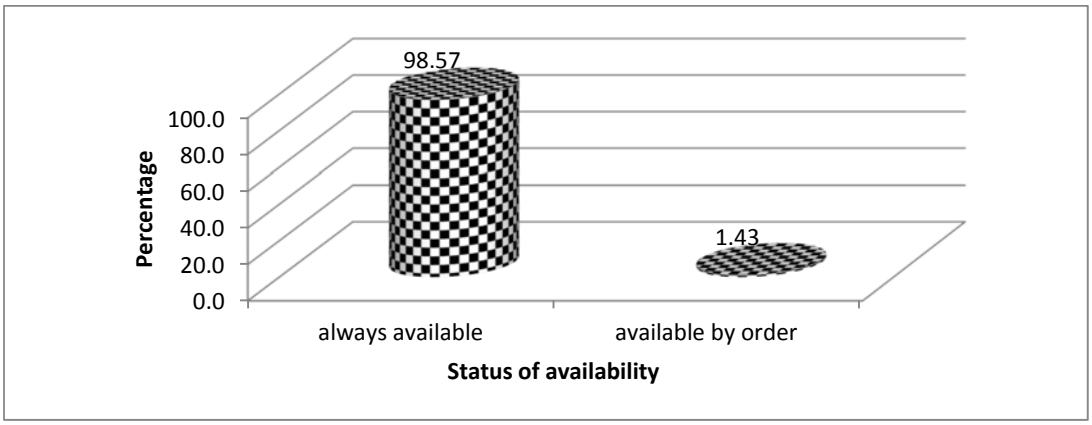

Figure 4.25: Feed availability at store.

Figure 4.26 shows that 21 % of farmers had to hire transport to deliver feed to their farm, while 4.5 % reported that feed was delivered to their farm by the suppliers. Unplanned transport is another factor that increases transaction cost that could also have a negative effect on the sustainability of the projects.

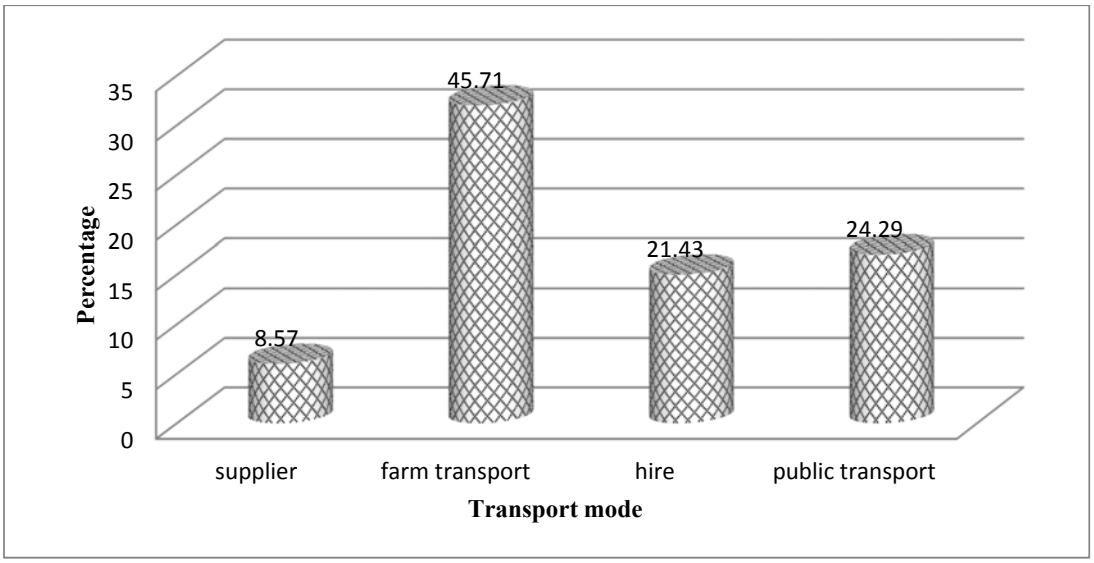

Figure 4.26: Feed deliveries to the farm

Bedding is an important production input in the supply chain of a poultry farm, especially broiler farms. Figure 4.27 shows the bedding supplier per ward; whether bedding was available at local cooperative or in another town. In this context bedding could mean peanut hull, shredded paper, wood shavings, sands or any other material that a farmer used as part of environmental enrichment. Most farmers in Ward 12 in Kraaipan village, indicated that bedding was always available at their local cooperatives. It is also important to determine if the bedding was always available or available by order or there was subjective availability.

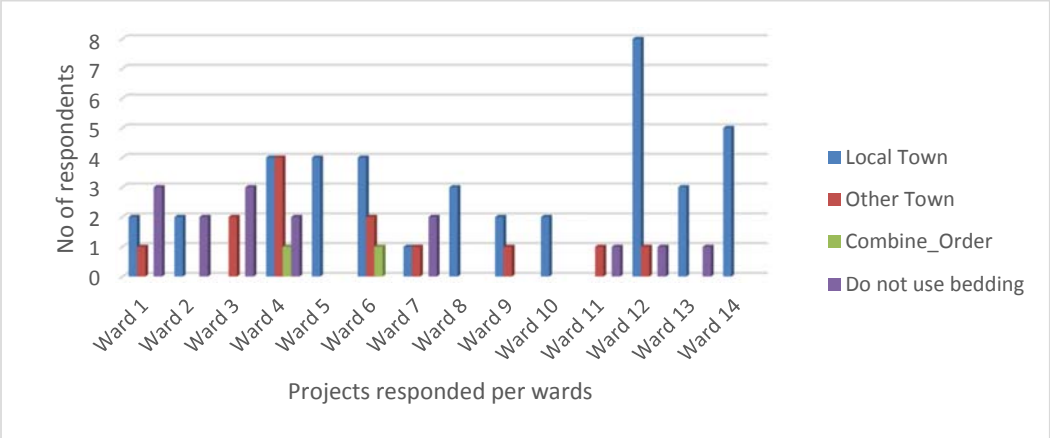

Figure 4.27: Bedding suppliers per Ward

Figure 4.28 indicates the response of farmers to questions about chicks and bedding; (22.5%) reported that chicks and bedding were not always available at their supplier. A sizeable number (57.7%) reported that chicks were available by order. This implies that farmers had to make a call to the local supplier to place an order. On the supply chain,; this activity, making a call using a cell phone implies that farmers have money to airtime and call the supplier to place an order. Communication costs can increase the production inputs of the farmers. All these small additional spending activities grouped together could have an effect on the supply chain and sustainability of the small-scale projects.

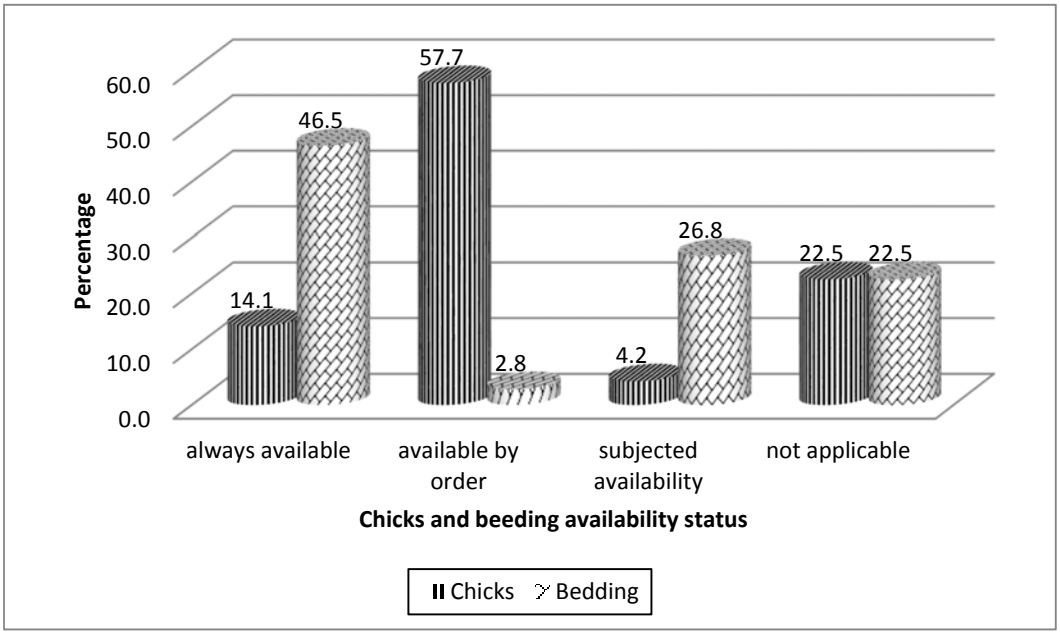

Figure 4.28: Chicks and Bedding availability

A small number (4.33%) of suppliers delivered production inputs such as disinfectants, bedding and vaccine to small-scale farmers. This can build a strong interconnected relationship with the supplier. It could also help to reduce the input production cost of small-scale farmers. Figure 2.29 summarises the delivery methods of farm inputs.

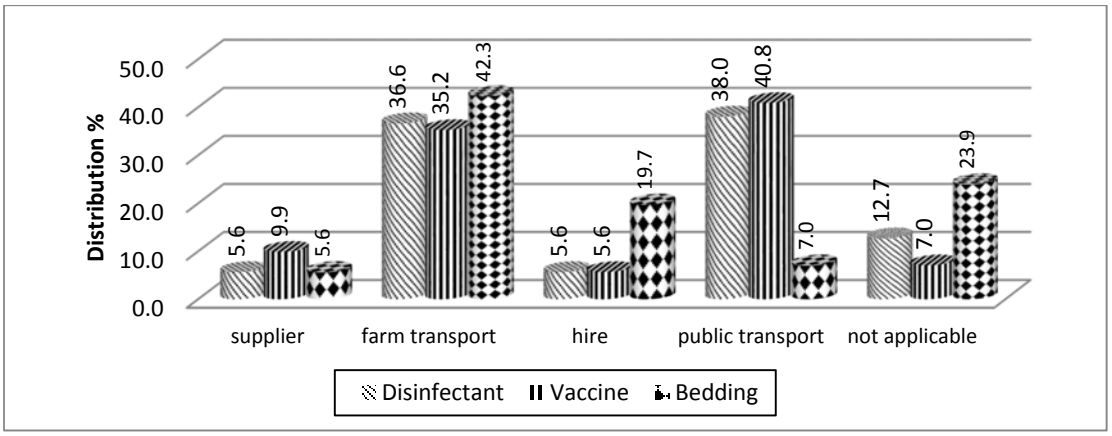

Figure 4.29: Transportation method used by farmers for their input

According to Figure 4.30, none of the respondents reported the purchasing of layers or pullets at their local supplier. This signifies that there are no point-of-lay suppliers in RLM. None of the local cooperatives supply laying hens or pullets. Out of fourteen Wards in RLM, respondents in nine Wards (Ward:1,2,3,4,7,11,12,13 and 14) said they had purchased their pullets at towns that are not close to RLM. This meant an additional cost for transport. If farmers were working together in a group, they could make arrangements with the supplier to deliver layers to them on a specific date and station. Possibly farmers could use one vehicle to collect their layers. This could reduce their spending on transport and thus contribute to lowering transaction costs.

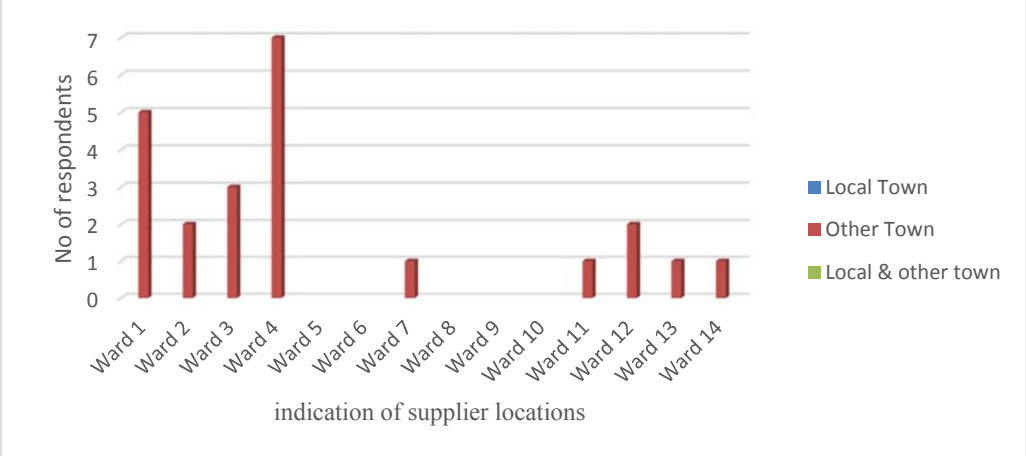

Figure 4.30: Layer supplier / place sourced.

The availability of layers is crucial to the sustainability of egg producing farms. Most farmers (19.7%) reported that layers were not always available even when they kept on enquiring. A few of farmers had to discontinue their poultry projects because of the unavailability of layers at local cooperatives or nearby farms. Figure 4.31 depicts the situation layer farmers are facing, in terms of procurement processes in the supply chain. Only a small number (8.5%) of egg farmers reported that layers were always available from their supplier. If small-scale farmers were working in a group, they would be able to notify other farmers about the availability of layers at certain far. This could facilitate the procurement process better.

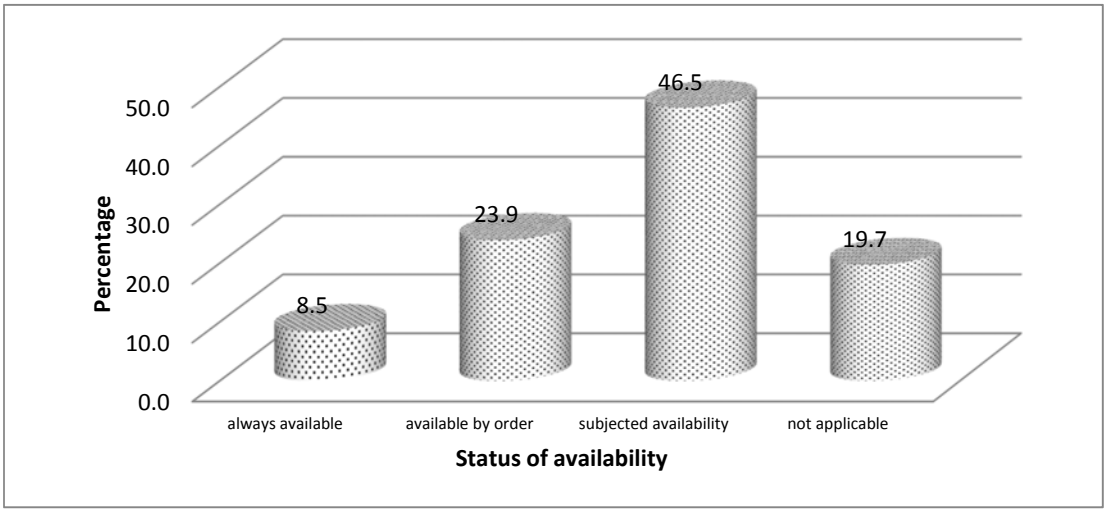

Figure 4.31: Layers availability

Delivery of farm product output is an important activity in the supply chain process. A transaction is only complete when the consumer has received the product and paid for it. To facilitate this activity farm transport is needed or a farmer has to hire a vehicle in order to deliver goods to the project site. Table 4.32 summarises the layer delivery method most of the small-scale poultry farmers in RLM used. Only 21.4 % of farmers reported that the supplier delivered the layers to their farms. This activity could also have an effect on the sustainability of the small-scale farm, without layers the farmer would not be able to sell eggs, thus leading to less income available for the household. The not applicable category on the Figures represents broiler farmers, the question was irrelevant to them because it was specifically asking questions that are related to layer farmers.

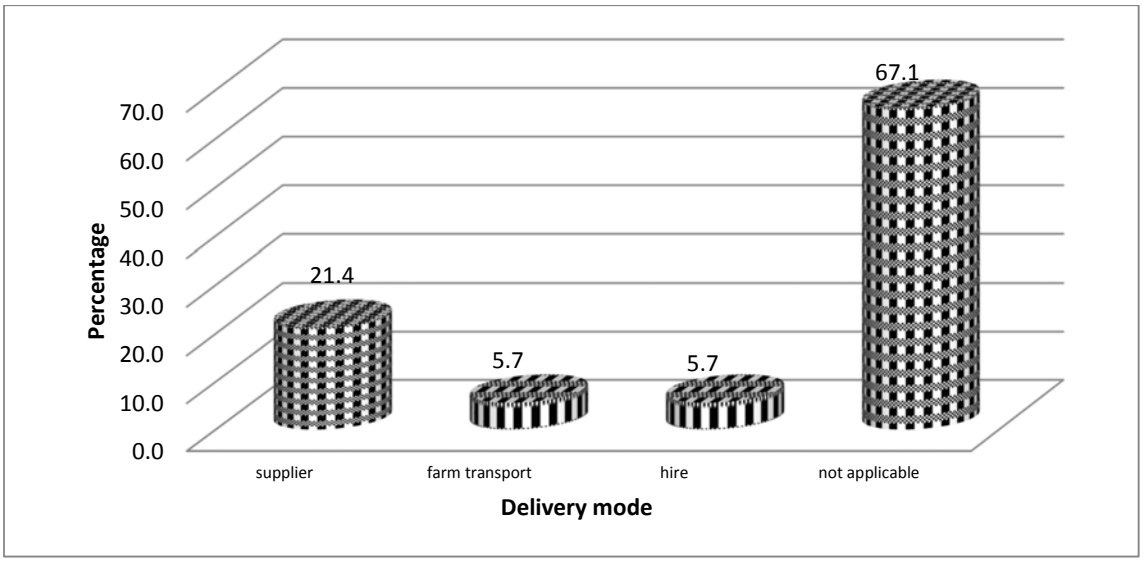

Figure 4.32: Layer deliveries to the farm

4.2.9 Physical infrastructure

Physical infrastructure such as tarred roads, electricity, boreholes on the farm, Department of Agriculture offices, central market availability in the villages, internet shops or libraries with internet services; is presented in Figure 4.33, 4.34 and 4.35. None of the villages in RLM had a poultry abattoir, this could contribute to making access to formal markets (supermarkets and restaurant) more difficult. The study findings concurred with Moreki (2011) assertion that majority of small-scale producers lack accredited slaughtering facilities, whereby 70 % of broiler farmers slaughtered their chickens on their backyard. Lack of abattoirs has negative effect on the sustainability of small-scale broiler farm since farmers will only rely on the live chicken informal market. In large-scale commercial farms when chickens reach five weeks they are ready for slaughtering. The transition saves farmers' money on poultry feeds, labour, water and reduce further mortality loss by slaughtering all five weeks old chickens while maximising the number of production cycles per year. In South Africa most formal chain stores do not sell live chickens. They only sell fresh or frozen chicken. In order for farmers to sell their products to these chain stores they will need the services of abattoirs and contractual agreement with those stores.

4.2.9.1 Tarred roads per ward,

As shown in Figure 4.33, only 22.9 % of villages in RLM do not have access to tarred roads. Ward 1, 2, 4 and 7 are the most affected. It means that delivery of production inputs can be costly and result in increasing the transaction cost. Most poultry farms in RLM have access to electricity (87.1%), have good working telecommunication network (91.4%). This could be beneficial to farmers who have to use cell-phone to contact the supplier when they have to place an order of chicks or other farm inputs. A greater number (65.7%) of farmers do not have access to boreholes in their respective farms. Having no access to water can be challenging because chicks have to drink water in order to perform satisfactorily.

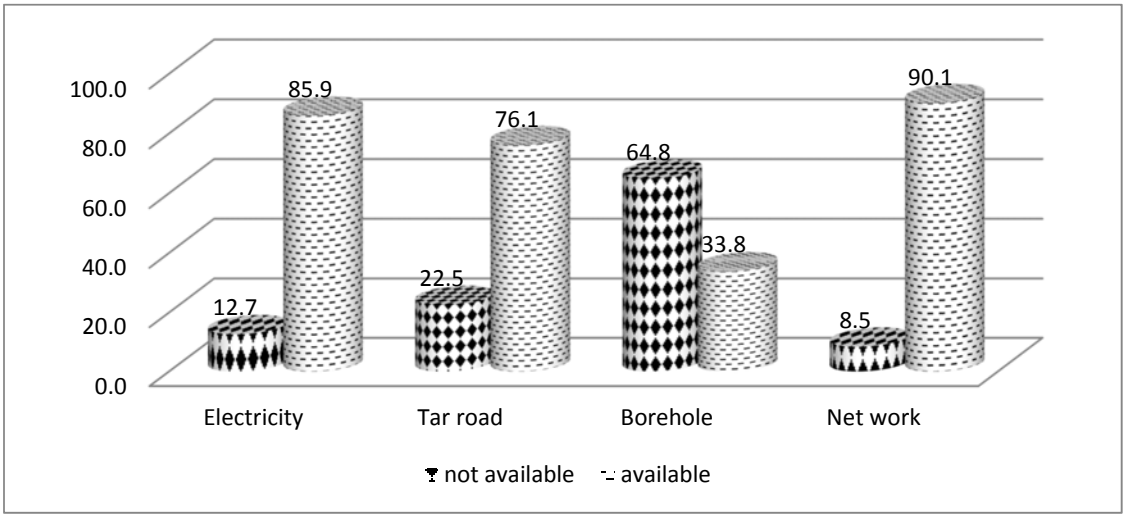

Figure 4.33: Summary of infrastructure availability for all projects

Agricultural offices are institutions that farmers can use to access the agricultural technical information that is shared by Extension Officers. These institutions are there to enable farmers to improve their farming production. The following Wards have no agriculture offices: Ward one, two, four, seven, eight, eleven and thirteen. Out of 14 Wards in RLM only nine have Extension Officer's offices. In this regard, farmers will have to make a call if they need help from the extension officers or drive to the nearest extension office for consultation. Regular calls also increase the transaction cost. The farmers who reside closer to Extension Officers offices could walk to the offices to request services without having to acquire additional cost such as transport or making calls.

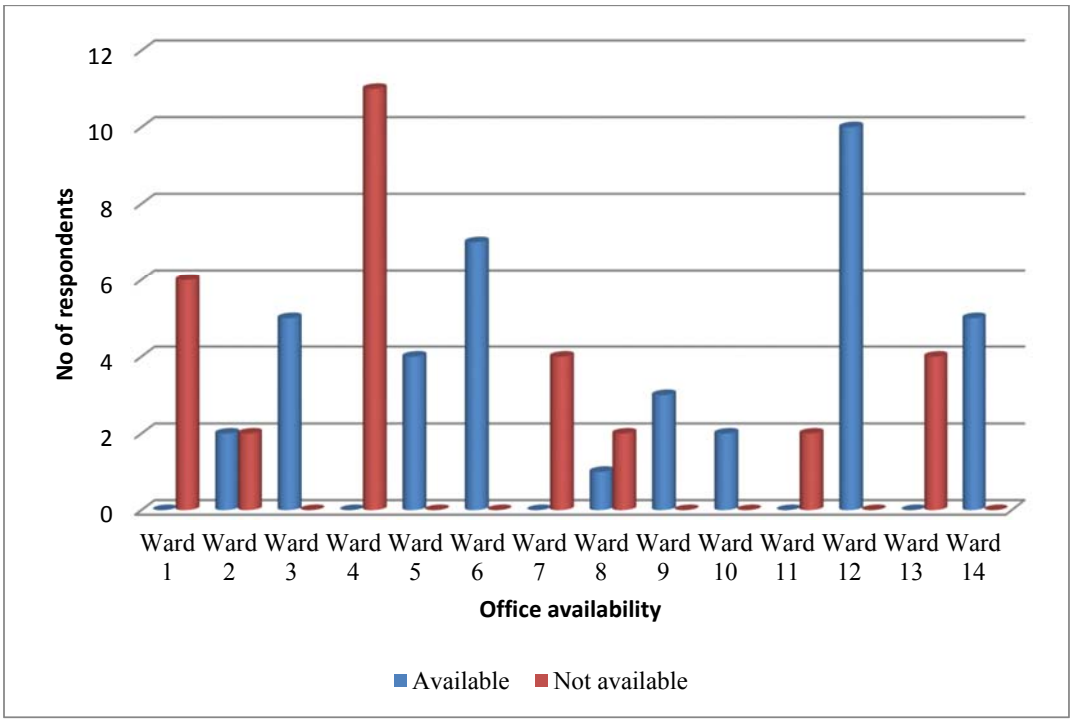

Figure 4.34: Department of Agriculture offices per Ward

4.2.9.2 Internet availability per Ward (public)

Access to the internet can help farmers to develop their business. According to Figure 4.35 Ward one, two, four, seven, eight, ten, eleven and thirteen had no access to the internet. These are the same wards, which did not have access to Agricultural offices. In Ward three, five, six, nine, twelve and fourteen, the internet was available at the local community library. The farmers were not asked if they had used the internet. The farmers who had access to technical information could use internet services to advance their production outputs. It could also help smallholder farmers to market their products, as they can reach markets that they do not have access to in their communities. They can advertise their products on community Facebook pages or community websites, which already exist in certain areas or need to be promoted.

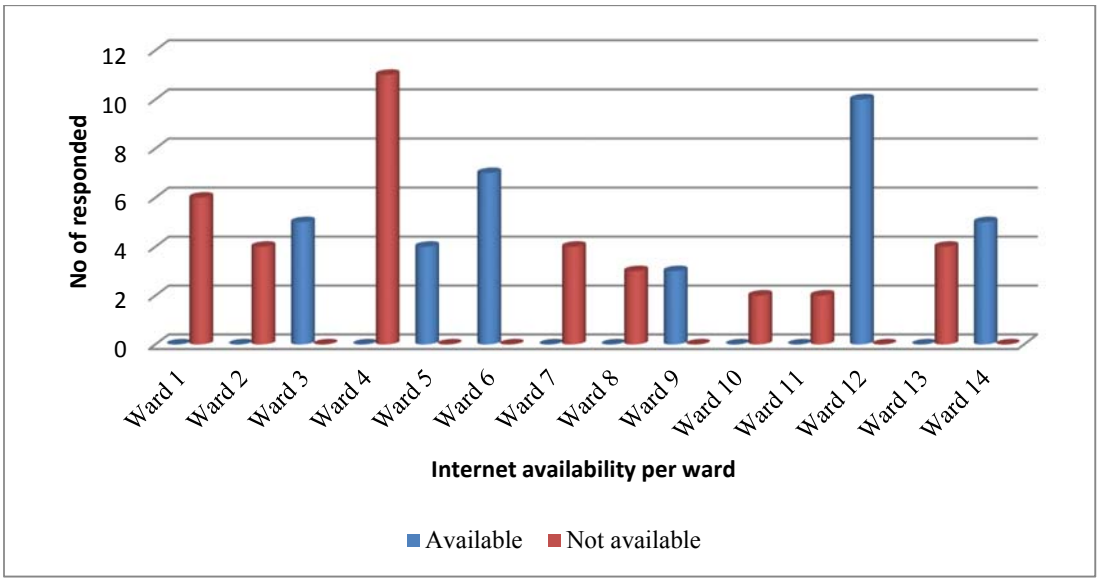

Figure 4.35: Internet available per Ward in RLM

4.3 LOGIT ANALYSIS FOR SUSTAINABLE OPERATION

The Logit Regression model was used to analyse determinants of supply chain factors for sustainable operation of small scale poultry projects. Table 4.9 displays the estimated results for the Logit regression analysis to explain the effect of supply chain factors for sustainable operation of small-scale poultry producers. The model summary of the goodness-of-fit results shows significant p-value ($p<0.000$) on Chi-square test.

The Logit regression analysis revealed that Logit coefficient estimates associated with payment level, credit availability, chick and feed suppliers had significant ($p<0.05$) contribution towards sustainability of the small-scale poultry farm. The results further show poor sustainability was highly influenced by lack of other variables that are attached to supply chain.

4.3.1 Principal Occupation

The Logit coefficient estimate associated with the principal occupation (Table 4.9) is negative and statistically significant at 10% level of significance, indicating a negative correlation between farmworker/project member (recorded as 1) and project owner (recorded as 0). This may imply that if the project is headed by a farmworker the probability of it being sustainable

will decrease. This may be due to the fact that workers might not be fully committed to the functioning of the business as compared to the principal owner.

Table 4.9: Result of the Logit regression analysis tested against sustainable operation of project

Parameter	**Estimate**	**Std. Error**	**Z**	**Sig**	**95% Confidence Interval**	
					Lower Bound	Upper Bound
Gender	-.044	.156	-.285	.776	-.350	.261
Age	.057	.051	1.113	.266	-.043	.157
Principal occupation	-.310	.186	-1.669	.095	-.674	.054
Number beneficiaries	-.105	.080	-1.323	.186	-.261	.051
Size-farm	.040	.095	.426	.670	-.145	.226
Annual records avail	-.455	.244	-1.860	.063	-.934	.025
Business plan avail	.135	.229	.591	.555	-.313	.584
Sales calendar avail	-.188	.172	-1.093	.275	-.525	.149
Distance market	-.010	.112	-.086	.932	-.230	.210
Type of payment	-.062	.069	-.900	.368	-.198	.073
Payment level	.103	.050	2.075	.038	.006	.201
Expenditure	.013	.035	.358	.720	-.057	.082
Credit avail	.606	.278	2.180	.029	.061	1.151
Transport expenditure	-0.07	.052	-.136	.892	-.108	.094
Income after sale	-.014	.055	-.249	.804	-.121	.094
Tarred roads	-4.40	.269	-1.634	.102	-.967	.088
Electricity available	-.097	.203	-.478	.632	-.494	.300
Borehole water avail	.310	.173	1.791	.073	-0.29	.649
Dept. Agric. offices avail	-.100	.155	-.643	.520	-.405	.205
DOC supplier	-.253	.111	-2.284	.022	-.470	-.036
Feed supplier	.230	.109	2.111	.035	.016	.444
Intercept	-.700	.503	-1.391	.164	-1.204	-.197

a. LOGIT model: (LOG(p/(1-p))=Intercept + BX

b.

4.3.2 Annual records availability

The results in Table 4.9 show that Logit coefficient estimate of annual records is negative and statistically significant at 10% level of significance, indicating a negative correlation between availability of records and sustainable operation of the small-scale poultry farm. This may imply that the available records were of poor quality rendering them not useful for farm management decisions.

4.3.3 Payment level of beneficiaries

The Logit coefficient estimate associated with the payment levels of beneficiaries is positive and statistically significant at 5% level of significance, indicating that the increase in payment levels of beneficiaries have positive influence on the sustainability of small-scale poultry farm. This may be due to the fact that respondents may be motivated with the increased level of payment and, therefore work hard to keep the farm going forward.

4.3.4 Credit availability to small-scale poultry producers

The results in Table 4.9 show that credit availability to smallholder poultry producers is positive and significant at 5% significance level, indicating that there is a positive relationship between credit availability and sustainable operation of the farm. It is assumed that if farmers have access to credit they will increase their production, acquire all the necessary production supplies and other inputs/equipment and undertake operational activities on time, earn more income and become more sustainable.

4.3.5 Borehole water availability per respondent on Logit

The variable “Borehole availability” has a positive and significant (10%) relation with farm sustainability indication that the availability of borehole per farm increase sustainable operation of the small-scale poultry farm.

4.3.6 Day old chicks' supplier in the study area

Availability of Day old chicks' suppliers in the study area has a negative and significant influence on the sustainability of the small-scale poultry farm at 5% significance level. It indicates a negative correlation between day old chicks' suppliers in the study area and operational sustainability of the farm. This could mean that the quality of day-old-chick supplied by local hatcheries in Ratlou Local Municipality is very expensive consuming all the profits for the farm. Factors that affects chick quality includes age of breeders, egg storage, temperature, relative humidity, and turning requirement in the incubator (Tona *et al*., 2005).

4.3.7 Feed supplier outcome from Logit analysis

The Logit coefficient estimate associated with feed suppliers' availability in the study area is positive and statistically significant at 5%. It indicates a positive correlation between availability of feed suppliers in the study area and the sustainable operation of the small-scale poultry project.

CHAPTER 5

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents conclusion and recommendations that are written to guide future research. The conducted study explored the effect of the supply chain on the sustainability of small-scale poultry projects in RLM. The small-scale poultry projects operate for a short period. The role and objective of these projects are to provide adequate food security and income to beneficiaries.

5.2 CONCLUSION

The outcome of research on suppliers to small-scale poultry was as follows: suppliers of DOC showed 57 .7 % availability. The feed suppliers showed 97.2 % availability with a mix of transportation modes. Bedding showed 46.5 % and was always available. Availability of layer hers was at 23.9 % while 46.5 % were subject to availability. The results revealed adequate availability of infrastructure with electricity at 85.9 %, tarred roads 76.1 %, telecommunication networks 90.1 %, markets, and boreholes 33.8 %.

Basic knowledge and skills are fundamentally important for the sustainable operation of any business including poultry enterprises. The current study revealed that 91.4 % of small-scale farmers did not know the name of their chicken breed, which reveal lack of knowledge about their product. The results show that farmers did not have access to manuals about chicken breeds they used on their farm. Lack of knowledge and managerial aspects regarding particular chicken breeds often leads to the failure of the enterprise. Although the South African government spends money on the salaries of extension officers, 84.5 % of farmers indicated that they did not receive any extension service in their area.

The analysis of poultry farmer training per individual respondent revealed that 43.7 % had experience on traditional farming while 38 % had no experience. It further shows 53 % of farmers acquired skills by self-training, 21 % through SETA accredited courses and 13 % through experience in commercial poultry farming.

The result of the Logit regression analysis revealed the Logit coefficient estimates that associated some variables related to supply chain had a statistically significant influence on the sustainability of a small-scale poultry farm. The outcome of the study lead to the rejection of hypothesis 1. The empirical analysis by Logit regression reveals that credit availability, day old chick suppliers, feed suppliers, and payment levels had statistically significant influence on the sustainability of small-scale poultry producers in RLM. Hypothesis 2 is accepted, since the empirical results did not show any influence of skills and knowledge contribution to the sustainable operation of small-scale poultry farms and their socio-economics in the current study.

5.3 RECOMMENDATION

Based on the findings, the study recommends the establishment of an integrated supply chain from suppliers of all production inputs; good housing facilities for specified poultry products; effective distribution channels; and accessibility to a good market. The study further recommends continuous infrastructure development in the villages to enable the efficiency of a desired supply chain model for small-scale poultry enterprises and other small enterprises from other industries that are feasible in a village setup. The establishment of a proper supply chain model would be ideal considering the revealed human capital in relation to skill and knowledge about poultry enterprise. Therefore, the study further recommends the continuous training of extension officers and young poultry entrepreneurs. Good training about poultry farming and established integrated supply chain can ensure sustainable operation and food security. There is a need for continuous research to determine how small-scale poultry farmers could gradually grow, to break through into commercial farming across the country. Any policy to improve the development of the small-scale poultry production in the study area should be informed by the significant variables of the logistic regression analyses.

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APPENDIX 1: CONSENT FORM AND QUESTIONNAIRE

CONSENT FORM

TITLE OF RESEARCH PROJECT: The impact of supply chain on sustainability of small-scale poultry farmers in Ratlou Local Municipality.

Dear Mr/Mrs/Miss/Ms/DR_____ Date _____2015

NATURE AND PURPOSE OF THE STUDY

The aim of the study is to establish the impact of supply chain on sustainability of Small-scale poultry projects in RLM of North west Province l. An interview will be conducted with the small-scale poultry farmers.

RESEARCH PROCESS

- The study requires your participation in the following manner:
- All small-scale poultry farmers in the Ratlou Local Municipality are requested to participate in the study.
- Respondents may be representative of any ethnic group, age or gender
- Basic demographic information will be required from you such as age, cell number, occupation, Language, educational background.
- The duration of this research project is a maximum of two hours.
- Each farmer will be provided with a questionnaire to read, after reading the interviewer will start asking questions.
- Pictures of poultry house will be taken only if the farmer agrees (both inside and outside)

CONFIDENTIALITY

Your ratings and assessments of any of the research instruments as well as your opinions are viewed as strictly confidential and only members of the research team will have access to the information. No data published in dissertations and journals will contain any information by means of which you may be identified. Your anonymity is therefore ensured.

WITHDRAWAL CLAUSE

I understand that I may withdraw from the study at any time. I therefore participate voluntarily until such time as I request otherwise. .

POTENTIAL BENEFITS OF THE STUDY

The results will be published on a journal while your anonymity is still preserved. Some researchers will read about the challenges that small-scale poultry farmers in Ratlou Local Municipality are facing.

INFORMATION

If I have any questions concerning the study, I may contact Mr Barileng Mogoje or Professor B. Nkonki-Mandleni

CONSENT

I, the undersigned, …….(full name) have read the above information relating to the project and have also heard the verbal version, and declare that I understand it. I have been afforded the opportunity to discuss relevant aspects of the project with the project leaders, and hereby declare that I agree voluntarily to participate in the project.

I indemnify UNISA and any employee or student of UNISA against any liability that I may incur during the course of the project. I further undertake to make no claim against UNISA in respect of damages to my person or reputation that may be incurred as a result of the project/trial or through the fault of other participants, unless resulting from negligence on the part of UNISA, its employees or students.

A copy of this consent form can be obtained from the researchers.

Signature of participant: .....

Signed at …… on ……

WITNESSES

1.....

2.....

QUESTIONAIRE

QUESTIONAIRE NO:….FARM NUMBER:……FARM NAME:……..……..

1.0 DEMOGRAPHY

1.1 Gender: 1.M☐ 2. F☐

1.2 Marital status: 1Married☐ 2Single ☐ 3Divorcee☐ 4Widow☐

1.3 Age: 1.30< ☐ 2.31-35☐ 3.35-45☐ 4.45-60 ☐ 5.60>☐

1.4 Highest education level: 1.No formal Schooling 2.Grade 1-7 ☐ 3.Grade 8-12 4.Tertiary ☐

1.5 Principal occupation: 1.Project owner ☐ 2.project member ☐ 3.farmworker

1.6 Home language: 1.Sotho ☐ 2.Setswana ☐ 3.Pedi ☐ 4. Xhosa ☐ 5.Zulu ☐ 6.Ndebele ☐ 7.Tsonga ☐ 8.Venda ☐ 9.Afrikaans ☐ 10. English ☐ 11. Other ☐

2.0 LOCATION OF FARM/ PROJECT

2.1 Location of the farm:

1. Madibogo ☐ 2.Madibogo-pan ☐ 3.Setlagole ☐ 4.Thutlwane ☐ 5.Setlhwatlhwe ☐ .6 Kraaipan ☐ 7.Disaneng ☐ 8.Tshidilamolomo ☐ 9.Makgobistad☐ 10. Logageng ☐ 11. Mareetsane ☐ 12.Makgori ☐ 13.Other ……

2.1.1 1.Section:…… ……. 2. Ward:……

3.0 DESCRIPTION OF FARM/ PROJECT

3.1 Farming activity:

1. Broiler ☐ 2.Layer ☐ 3. Broiler & Layer ☐ 4.Indigenous ☐

3.2 Type of house:

1Control environment ☐ 2.Open sided ☐ 3.Old brick house ☐ 4.Garage ☐ 5.Organised material ☐

3.3 Size of the farm:

1. <200 ☐ 2.200-500 ☐ 3.500-1000 ☐ 4.1000-2000 ☐ 5.2000-5000 ☐ 3.3

3.4 Number of owners/Beneficiaries:

1.1☐ 2. 2-5☐ 3.6-10☐ 4.11-15☐ 5.16-20 ☐ 6.21> ☐

3.5 Source of funding for start-up:

1. Government ☐ 2.NGO ☐ 3.Self-contribution ☐ 4.loan/grant ☐ 5.other ☐

3.5.1 Name of Funder:

1. Department of Agriculture ☐ 2.Social development☐ 3.Eskom ☐ 4.Self-contribution ☐ 5.IDT ☐ 6.IDC☐ 7.NEF ☐ 8. DTI☐

3.5.2 Commercial bank:

1. FNB ☐ 2.ABSA ☐ 3.STANDARD☐ 4.CAPITEC☐ 5.NEDBANK ☐

3.6 Current status:

1. Operating ☐ 2. Not operating ☐ 3. Interval ☐

3.7 Reason for not operating?

1. No funds ☐ 2.disagreement ☐ 3.no profit ☐ 4.shortage of resource not benefiting ☐ 5.Other…….

3.8 Breed used:

1. Cobb 500 ☐ 2.Ross ☐ 3.other ☐ 4.don't know ☐

3.9 Farm Transport:

1. Vehicles ☐ 2.Truck ☐ 3.Tractor☐ 4. Hire ☐ 5.Other ☐

3.10 Storage:

1. Farm store ☐ 2. Inside chickens house ☐ 3. Member place ☐

3.11 Heating system:

1. Electricity ☐ 2.Gas ☐ 3.Paraffin ☐ 4.Gas ☐ 5.Not available ☐ 6.Other ☐

4.0 OPERATIONAL MANAGEMENT ASPECTS

4.1Daily routine:

1. Owner ☐ 2. Owner & Assistant ☐ 3. and Family ☐ 4.All beneficiaries ☐

4.2 Staff rotation:

1. 2 in two days ☐ 2. 1 off after handing over to other ☐ 3.All members working daily ☐ 4.Other method……..

4.3 Record keeping:

1. Daily ☐ 2.Monthly ☐ 3.Only on deliverie ☐ 4. only sales ☐ 5.both sales and ☐ deliveries 6.No records ☐

4.4 Annual Production:

1. Records available ☐ 2.Records not available ☐

4.5 Business plan:

1. Available ☐ 2.Not available ☐ 3.Other…….

4.6 Financial planning:

1. Available ☐ 2.not available ☐

4.7 Repayment of loan:

1. Once a year ☐ 2.Every broiler cycle ☐ 3.Every month ☐ 4.Every six months ☐ 5.Once year ☐ 6.Other

5.0 SKILL THROUGH TRAINING AND EXPERIENCE

5.1 Skill:

1. Train in agriculture at High School ☐ 2.Trained by Seta ☐ 3.experience in commercial poultry ☐

5.2 Experience:

1. Commercial poultry farming ☐ 2.Village poultry ☐ 3.No experience in chickens ☐

5.3 Extension service:

1. Regular ☐ 2.Seldom ☐ 3.N/A ☐

6.0 SALES AND MARKETING

6.1 Sales schedules:

1. Sales calendar available: ☐ 2.Not available ☐

6.2.1Age of Broiler marketing:

1.5 weeks ☐ 2.6 weeks ☐ 3. 7 weeks ☐ 4. >8 weeks ☐ 5.Other

6.2.2 Duration of broiler sales:

1.1 day ☐ 2.1 week ☐ 3.2 weeks ☐ 4. 4 weeks ☐

6.3.1 Layers:

1. Daily sale ☐ 2.weekly deliveries ☐ 3.other

6.3.2 Duration of eggs sales: 1.daily production ☐ 2. Weekly production ☐

6.4 MARKET:

Market Stall infrastructure available?

1.Yes ☐ 2.NO

6.4.1Target market:

1. Community ☐ 2.Tuck shops ☐ 3.Hackers ☐ 4.Super market ☐ 5. Butchery ☐ 6.Contract sale ☐ 7.Other ……

6.4.2 Distance to the market:

1.1-5 km ☐ 2. 5-10km ☐ 3. 10-20km ☐ 4. 20km>

7.0 PAYMENT

7.1 Payments:

1. Once a year ☐ 2. Every broiler cycle☐ 3. Every month☐ 4. Every three months ☐ 5. Every six month ☐

7.2 Type of payment:

1. Monetary payment☐ 2. Kind payment/product ☐

7.3 Level of payment per individual in money:

1. <R1500☐ 2.R1501-R2000☐ 3.R2001-R3000☐ 4. R3001-R5000 ☐ 5.>R5000☐

7.4 Level of payment per in kind:

1. <R1500☐ 2. R1501-R2000☐ 3.R2001-R3000☐ 4. R3001-R5000 ☐ 5. >R5000 ☐

7.5 Expenditure

7.5.1 How much approximately do you spend on stock in general per month?

1. <R500 ☐ 2. R500 - 1000☐ 3 R1000 - 2000☐ 3 R2000 ☐ 4 2000-5000 5. 5000-10000☐ 6. 10 000 -20 000☐, 7. 20 000-50 000☐

7.5.2 Credit available

1. Yes ☐ 2 no☐

7.5.3 Transport

1. Own vehicle ☐ 2. Hired vehicle ☐ 3 trolley☐ 4. other☐

how much do you spend on transport:

<500☐ 2. 500-1000 ☐ 3. 1000-2000 ☐ 4. 2000-3000☐ 5. other ☐

7.5.4 Income after selling?

<2000 ☐ 2. 2001-4000☐ 3. 4001-6000☐ 4. 6001-8000.00☐ 5. 8 001-10 000☐ 6.other☐

8.0 SUPPLIERS

Product supplied	Place where sourced?			Availability			Delivery to farm			
	Local coop or town	Other Town	Combine in order	Always Available	Available by Order	Subjected availability	By Supplier	Farm transport	Hire transport	Public transport
8.1 Day old chick										
8.2 Feed										
8.3 Bedding										
8.4 Vaccine										
8.5 Disinfectant										
8.6 Layer										
8.7 Medication										
8.8 Electricity,										
8.9 Other										

9.0 INFRASTRUCTURE DEVELOPMENT

Infrastructure in the village	Available	Not Available	Other
9.1 Tare road in the village or near farm			
9.2 Electricity			
9.3 Water in the farm Borehole			
9.4 Department of agriculture offices			
9.5 Abattoir			
9.6 Shops or mall			
9.7 Central market			
9.8 Internet			
9.9 Cell phone network			

APPENDIX 2: PICTURE OF POULTRY PROJECTS PARTICIPATE ON STUDY

Ratlou Local Municipality community poultry projects (operational &non-operational)

Fig:1

Fig:2

Fig:3

Fig:4

Fig:5

Fig:6

Fig:7

Fig:8

Fig:9

Fig:10

Fig:11

Fig:12



Fig:13 Fig:14 Fig:15



Fig: 16 Fig:17 Fig:18



Fig:19 Fig:20 Fig:21



Fig:22 Fig:23 Fig:24



Fig:25 Fig:26 Fig:27



Fig:28 Fig:29 Fig:30



Fig:31 Fig:32 Fig:33



Fig:34 Fig:35 Fig:36

Fig:37 Fig:38 Fig:39

Fig:40 Fig:41 Fig:42

Fig:43 Fig:44 Fig:45

Fig:46 Fig:47 Fig:48



Fig:49 Fig:50 Fig:51



Fig:52 Fig:53 Fig:54



Fig:55 Fig:56 Fig:57