COMPARATIVE INVESTMENT ANALYSIS FOR SMALL SCALE BROILER AND LAYER ENTERPRISES IN ZAMBIA

by

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B.S., University of Zambia, 2010

A THESIS

Submitted in partial fulfillment of the requirements

for the degree

MASTER OF AGRIBUSINESS

Department of Agricultural Economics

College of Agriculture

KANSAS STATE UNIVERSITY

Manhattan, Kansas

2013

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ABSTRACT

Small scale broiler and layer production constitutes a significant part of the poultry industry in Zambia. However, the contribution of small scale enterprises to broiler production is more pronounced than layers with statistics showing 60 and 30 percent for broilers and layers, respectively. This study was carried out for the purpose of determining the economic profitability of both broiler and layer enterprises and also to evaluate their degree of attractiveness for investment. The thesis used the Net Present Value and Internal Rate of Return methods to determine the economic profitability for both broiler and layer enterprises. The data used in the analyses were obtained direct from the market and additional data were extracted from the Cost of Doing Business Manual 2012, a publication of the Zambian Development Agency. Additionally, the study used a capital investment of US $50,000 for each enterprise, 25 percent opportunity cost of capital and an economic life of five years.

The data were used in estimating the enterprise budgets for both broiler and layer enterprises from which income statements were generated. The enterprise budget for broiler production estimated revenue from the sale of live broiler chickens at a wholesale price while the layer enterprise budget estimated its revenue from the sale of eggs and culled hens. The sale prices used were US $5 per broiler chicken, US $3.60 per tray of eggs and US $2 per culled hen as obtaining on the market at the time. In addition, production was estimated at 60,000 broilers and 30,000 trays of eggs from 3,000 layers annually.

The cost of constructing brooder houses and purchase of production equipment were the major cost components for the two enterprise budget estimates. The estimates

indicated that these two cost components amounted to US$27,090 and US$21,095 for boiler and layer enterprises respectively. The other cost component was production cost and it includes the cost of labor, feed, day old chicks, marketing, vaccines, transportation, electricity, debeakers, heaters, stationery, etc. The cost of feed constituted about 65 percent of total production cost for layer enterprises and about 60 percent for broiler enterprises. The total production cost as a percentage of revenue was estimated at 80 percent and 70 percent for broiler and layer enterprises, respectively.

The analyses were completed under three alternative scenarios that included optimistic, expected and pessimistic scenarios. The analyses across all scenarios show that both broiler and layer enterprises are economically viable for investment though the broiler enterprise is more economically profitable than the layer enterprise. They both show positive NPVs and IRRs in excess of the 25 percent opportunity cost of capital used in the analysis. The analysis for broiler enterprise showed a NPV of US $178,242 for the optimistic scenario, US $122,742 for the expected scenario and US $30,550 for the pessimistic scenario. Results obtained from layer enterprise analysis showed NPVs of US $72,388, US $49,260 and US $11,186 for the optimistic, expected and pessimistic scenarios, respectively. Consistent with the decision rules of the NPV and IRR methods, both enterprises were found to be economically viable for investment. On a comparative basis though, the small scale broiler enterprise was found to be more attractive for investment than the small scale layer enterprise as indicated by the results of the NPVs and IRRs. The lucrative nature of the broiler enterprise and easy of management could be used

as possible explanation to the current investment trends seen in the Zambian poultry industry.

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ACKNOWLEDGMENTS

The author wishes to unreservedly thank Dr. Allen M. Featherstone for the professional guidance and support that he rendered during the course of the study. Gratitude is also extended to all the MAB staff for their unwavering support during and after the MAB course sessions from which the author drew the necessary knowledge and expertise that was used in conducting this research successfully.

The author would like also to pay special tribute to Dr. Vincent Amanor-Boadu, PVCI-Zambia project Director for the PVCI scholarship that provided financial and material support towards this study and the MAB programme in general. Furthermore, the author wishes to extent appreciation to Dr. Gelson Tembo and colleagues from both Zambia and overseas for their contribution during the MAB programme and specifically during the preparation of this professional thesis.

Finally, the author wishes to thank his family for the understanding, patience and encouragement rendered during the course of the MAB programme. To my wife Judith A. Mwansa, I dearly thank you for providing me with unshaken emotional support during my MAB programme.

CHAPTER ONE: INTRODUCTION

The poultry industry is a well recognised sector of the Zambian economy. It currently contributes 4.8 percent to agriculture gross domestic product (GDP) and 48 percent to the livestock sector. Poultry provides a major income-generating activity from the sale of eggs, broiler meat and culled hens for many small scale farm enterprises. It also provides gainful employment for many semi-skilled and skilled labour forces. Ngosa (2012) states that, "the poultry sector in Zambia generates direct and indirect income and employment for about 80,000 people, 50,000 of which are permanent and 30,000 seasonal jobs". The industry is dominated by hybrid chicken species that provide quality meat in the case of broiler strains and eggs for layers. Poultry meat continues to be the primary meat consumed in Zambia accounting for an estimated 50 percent of total meat consumption followed by beef at 28 percent; together pork and fish account for 16 percent, and others at 6 percent (Ngosa 2012).

Broiler production is widespread and encompasses both small and large scale producers. Small scale producers dominate broiler production while large scale producers dominate egg production. The total production of broiler meat for 2011 was 72,000 tonnes of which the main product was the whole chicken, frozen or cooled, with growing segments of cuts and industrialized chicken. In 2007, small scale producers were estimated at slightly above 50 percent of the total broilers produced. The proportion increased to 60 percent in 2012, according to statistical estimates released by the Poultry Association of Zambia (PAZ, 2012). Furthermore, the production of broilers is tightly concentrated around the capital Lusaka, the Copperbelt province and other main towns, providing an opportunity for producers to take advantage of the major cities and towns' high table

chicken consumption rates due to the high population densities and high disposable income in these areas (Mukabalai Ndiyoi 2008).

Egg production currently stands at 1.45 million eggs per day or 43.5 million eggs per month translating into a consumption of 3.38 eggs per person per month or 41 eggs per capita consumption (Ngosa 2012). Unlike the broiler subsector, egg production is dominated by large scale producers that represent 70 percent of the total egg production.

The poultry industry has showed continued stronger growth than other industries in the livestock sector. The future outlook is still very attractive. Currently, the industry is growing at 25 percent for layers and 30 percent for broilers annually according to the Poultry Association of Zambia. This growth has been influenced by both demand-side and supply-side factors. Demand-side factors include increased human population, increased disposable income from the emerging middle class and urbanization. Supply-side factors also contribute significantly to growth due to factors such as advances in breeding that has given rise to birds that meet specialized purposes and are increasingly productive though they require expert management. The development and transfer of improved feed, slaughter and processing technologies also have increased safety and efficiency though they favor large scale units rather than small scale producers. The industry has developed capacity for the production of quality feed, improved hybrid day old chicks as well as processing capacity that encourages contract farming.

This thesis was completed to determine the economic profitability of small scale broiler and layer enterprises. It further aimed at determining their degree of attractiveness for investment. It also wanted to provide possible explanations to the investment trends that are observed among small scale enterprises in the poultry industry.

1.1 Problem Statement

Investment in the poultry industry has been largely driven by the private sector both domestic and foreign. Investment by small scale enterprises in the poultry industry has focused largely on small scale commercial production with little or no value addition. However, large enterprises are becoming more vertically integrated. Since the time of economic liberalization of Zambia, there has been more investment in broiler production by small scale enterprises compared to investment in layers. Statistics indicate that small scale enterprises constitute 60 percent of broiler producers and 30 percent layers. However, it is difficult to tell whether investment in either small scale broiler or layer production is economically viable as there has not been any documented study to examine this. Furthermore, no good explanation has been provided as to why more small scale entrepreneurs invest in broiler production than in layers. It is also not clear as to which of the two enterprises is more profitable at a small scale level.

From the investment point of view and in the context of a small scale enterprise, this study focuses on answering the major question of how attractive is the small scale broiler or layer enterprise for investment? Specific questions that are to be answered in this thesis include:

1. Is investment in either small scale broiler or layer production economically viable?
2. If so, how comparable are their economic profitability?
3. Does economic profitability explain the investment patterns observed among small scale poultry enterprises?

1.2 Objectives

The purpose of this thesis is to determine the economic profitability of both broiler and layer production and also their degree of attractiveness for small scale investment. The thesis also sought to understand whether the investment pattern in the two enterprises is influenced by economic profitability.

The study investigated and analysed the two enterprises based on a small scale enterprise definition provided by the Zambian Development Agency (ZDA). According to the ZDA, "small scale enterprise shall be any business enterprise registered with the Registrar of Companies whose total investment excluding land and buildings is between US$30,000 and US$50,000". However, for the purpose of this study, US$50,000 initial investment was used for the analysis.

1.3 Rationale

The present business environment is very dynamic and requires making rational investment decisions. It is important to note that every investor has the opportunity or option but not the obligation to invest in a particular project of a particular industry at a given time for a particular period of time. Because of the limited reversibility of investment projects, it is important to consider many business opportunities and all associated risks before making a final investment decision. The investment appraisal is the starting point in determining the worthiness of a prospective project. The profitability of any kind of investment in any industry is the return earned on the investment. The economic profitability of each enterprise is used to determine the attractiveness of the enterprises. The more economically profitable a project is, the more attractive it is for investment and vice versa.

Net Present Value (NPV) and the Internal Rate of Return (IRR) were used to determine the economic profitability of each enterprise mentioned. Microsoft Excel 2007 was used for all calculations related to the analysis.

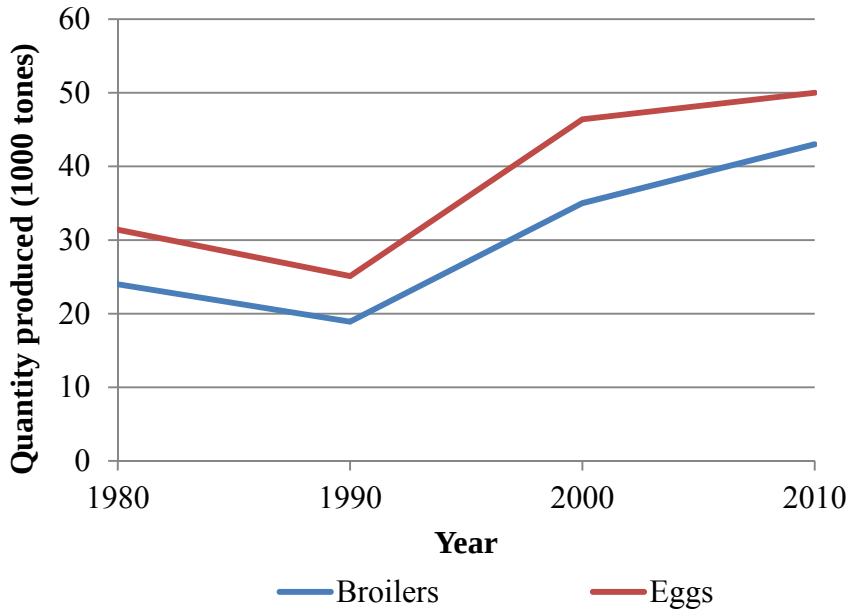
The unit of measure used in this study is the US Dollar (US$) with the conversion to Zambian Kwacha (ZMW) quoted at an exchange rate of KR5 to US $1 as reflected in the Cost of Doing Business in Zambia (ZDA 2012).

Chapter 2 of the thesis discusses general overview of the poultry industry in Zambia. Chapter 3 reviews the literature related to the poultry industry and investment. Chapter 4 discusses the conceptual model of the study. The methodology used in the analysis is presented in chapter 5. The results/findings are presented and discussed in chapter 6 and chapter 7 presents conclusions and recommendations.

CHAPTER TWO: OVERVIEW OF THE POULTRY INDUSTRY IN ZAMBIA

The poultry industry consists of three distinctly separate branches, namely the day old chicken supply, the layer and the broiler. The broiler industry is defined as all the processes and actions revolving around the production, processing, marketing and consumption of chicken meat, while broilers are defined as meat-type chicken strains that are raised specifically for the production of meat (Ndiyoi, et al. 2007). In addition, the layer industry involves all processes and actions revolving around the production, processing, marketing and consumption of eggs and culled hens, while layers are chicken strains that are specifically raised for the production of eggs (Ndiyoi, et al. 2007). Production of poultry products in Zambia has been increasing since 1990s. Figure 1.1 shows production trends of broiler meat and eggs from 1980 to 2010.

Figure 2.1: Production Trends of Broiler Meat and Eggs from 1980 - 2010.



Source: FAO-Production Statistics

Of the slightly more than 13 million people in Zambia, the majority are involved in agriculture and agricultural related businesses. In 2000 for instance, it was estimated that 60 percent of the country's population were involved in agricultural activities, of which 97.4 percent were involved in crop production while 67 percent were involved in poultry, and while 29 percent were in livestock (Ndiyoi, et al. 2007). The poultry industry is an important industry in the country and provides food, a source of income and is vital in job creation. Poultry provides a major income-generating activity from the sale of eggs and chicken meat. It provides gainful employment for many semi-skilled to skilled laborers. According to Ngosa (2012), "the poultry sector generates direct and indirect income and employment for about 80,000 people, 50,000 of which are permanent and 30,000 seasonal jobs". The poultry industry in Zambia can be regarded as dualistic, in that it involves both small and large commercial producers each targeting a specific market segment. More than 60 percent of broiler meat is produced by small broiler enterprises compared to 30 percent for egg production.

2.1: Economic Performance and Policy Environment

The growth of the poultry industry in Zambia can be attributed to many factors and it is undeniable that the freeing of the Zambian economy from government control in 1993 as well as the good macroeconomic performance that the country has recorded in the recent past has contributed to the growth and development of the poultry industry. Zambia's economic performance in the recent years has been positive with real Gross Domestic Product (GDP) growth rising to 6.8 percent in 2011 from 5.3 percent in 2005. This was the sixth year in a row in which the economy grew above 5 percent. The strong economic performance the country has recorded is as a result of increased output in mining and

quarrying, construction, and agriculture. Table 2.1 shows selected macroeconomic performance indicators for the country between 2005 and 2011.

Table 2.1: Selected Macroeconomic Performance Indicators, 2005-2011

	2005	2006	2007	2008	2009	2010	2011
Real GDP growth (end-year %)	5.3	6.2	6.2	5.7	6.4	7.6	6.8
GDP per capita (end-year US $)	650	908	949	1,170	1,050	1,200	1,463
Annual Inflation end-period (%)	15.9	8.2	8.9	16.6	9.9	7.9	7.2

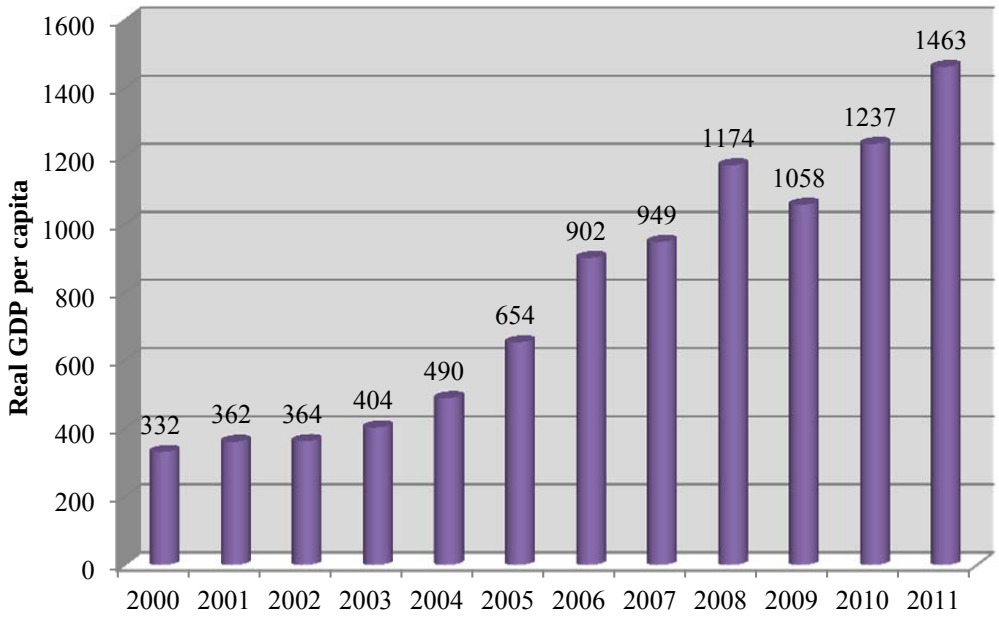
Source: ZDA, Investor Guide Handbook

Zambia has made many reforms in the economic sector that are aimed at promoting private sector participation in the economic development of the country. Being a multi-party democracy, the country has pursued a market-oriented liberalized economy with investment laws that provide incentives for investment made in priority sectors of the economy. These laws are aimed at increasing levels of foreign direct investment (FDIs), domestic investment, increased international trade as well as increased domestic economic growth. Furthermore, the government has abolished controls on prices, interest rates, foreign exchange rates and provides free repatriation of debt repayment and offers 100 percent repatriation of profit. In addition, the government offers guarantees and security to investors with legislated rights to full and market value compensation. For new businesses, the government has provided for tax exemption for a duration of between three and five years depending on the nature and amount of investment. Zambia, being a member of regional bodies such as SADC and COMESA, offers duty free market access to more than 400 million people in the region.

The country has also seen a sustained increase in the real per capita income from US $332 in 2000 to US $1,463 in 2011. The increase in the per capita income is a clear

indication of the country's economic performance that has resulted in increased disposable income for many Zambians. Figure 2.1 illustrates the trends in Zambia's real per capita GDP from 2000 to 2011.

Figure 2.2: Trends in Zambia's Real Per Capita GDP, 2000-2011



Source: ZDA Investor Guide Handbook

Domestic policies such as market liberalization, regional integration and foreign direct investment (FDI) have brought private companies and corporations into the supply chains of most agricultural products. The arrival of large firms, especially in food retail and processing, has been accompanied by increased concentration of the processing and retail sectors of the food chain. The entry of supermarkets in the Zambian economy has been due to the environment the government has created for FDIs and has significantly opened up opportunities for large scale producers of poultry products. However, while the increased involvement of supermarkets has opened up opportunities for local large scale farmers and

processors, stringent quality and consistent supply requirements tend to exclude many small-scale producers from participating in the modern supply channels.

Unlike crops, the poultry industry has seen little government intervention that distorts market prices allowing market forces to drive the industry. The National Agricultural Policy (NAP) stipulates the role of the government in the poultry industry and this is to create an enabling environment for active private sector participation in the improvement of the productive efficiency of the livestock sector in a sustainable manner and support the marketing of both livestock and livestock products and contribute to food security and income. The policy sets specific roles of government such as to promote, facilitate and enhance the participation of the private sector in production, processing and marketing of quality livestock products. However, the Minister of Agriculture and Livestock has the power to impose import or export bans whenever deemed necessary for the benefit of domestic producers and consumers. The poultry industry has been cited as an infant industry in Zambia, hence, protectionist tendencies have been advanced by major stakeholders that have seen the government impose a ban on importation of poultry products such as broiler meat and table eggs.

2.2 Production of Day Old Chicks

Increased investment in the poultry industry has resulted in increased numbers of hatcheries from two hatcheries before economic liberalization to eight major breeding and hatching facilities with state of the art technology. There has been expansion in the breeder sector with hatcheries increasing in capacity and in numbers. The hatcheries include: Hybrid Poultry Farm (Z) Ltd, Ross Breeders Zambia, Bokomo Zambia, Progressive

Poultry (Tiger Chicks), Zambian Poultry Breeders, Panda Hill Hatchery, Chipata Hatcheries and Chick Masters.

The increased investment in infrastructure and capacity has led to a significant increase in the production of day old chicks, which has increased to an annual production of 51 million day-old broiler chicks. For layers, the day-old chicks are supplied mainly by Hybrid Poultry Farm and Bokomo. In addition, approximately 10% of the chicks for layers are imported. The largest consumer of imported day old layer pullets is Golden Lay Farm. Pullet chicks are usually imported if the order is larger than the local hatcheries are able to hatch at that particular time.

2.3 Broiler Production

Broiler production is more widespread in Zambia and encompasses both small and large commercial producers. More than 60 percent of broiler production involves small scale producers. Broiler production is tightly concentrated around the capital Lusaka, the Copperbelt province and other main towns, providing an opportunity for producers to take advantage of the major cities and towns' high table chicken consumption rates driven by these areas' high population densities and high disposable incomes.

Broiler production has increased to 51 million birds, providing more than 72,000 tons of table chicken meat annually. Private investment in processing facilities has resulted in the establishment of four major broiler processors namely: Crest Chicken, Eureka Chicken, Verino Country Choice Chickens and Zamchick. Since the processing plants are located in Lusaka, with only one in the Central province, most producers are situated close to these locations. Of the total number of broilers produced annually, approximately 65 percent of these are sold dressed, while the live bird market (dominated by small scale

producers) accounts for 35 percent (Ndiyoi, et al. 2007). According to PAZ, in 2012 the amount of broilers processed per week through the processors within the industry were around 700,000 broilers per week compared to the volume of production in 2009 that was around 200,000 broilers per week. The increased demand for dressed chicken has been attributed to the increase in demand for quality and safety, but is also due to shortage and the high price of beef on the domestic market.

Broiler production for small scale commercial enterprises is mainly done intensively in a deep litter system where birds are fully confined. In this production system, the floor is covered with a deep litter of about 5 to 10 cm of wood shavings or a similarly absorbent material. This means that the birds are provided with all their requirements such as food, water, light and care. The primary aim of a broiler house is therefore not to keep the birds in a confined area, but to create an environment that allows the broiler to achieve its genetic potential in the most economical manner possible. Most of the housing units for broilers are naturally ventilated hence orientation of the structure is important. The recommended environmental requirements inside the house are as indicated in the table below.

Table 2.2: Average Environmental Requirements for Broiler Production

Age	Temperature (Degree Celsius)	Humidity (% RH)	Ventilation (m3/h/bird)	Light Intensity (watts/20m^2)
Week 1	31-28	35-70	0.1-0.3	40–60
Week 2	28-25	35-70	0.3-0.6	40–60
Week 3	25-21	36-70	0.6-0.8	15
Week 4	21	36-70	0.8-1.0	15
Week 5	21	37-70	1.3-10	15
Week 6	21	37-70	1.7-14	15

Source: Livestock Services Cooperative Society

The management of the flock is one of the most important aspects in broiler production. This starts as soon as the chicks are bought and placed into the brooder room. It is important that adequate water, heat and feeders are provided for birds at all stages of development. The table below shows the recommended number of drinkers and feeders for 1000 birds.

Table 2.3: General Recommendation for Drinkers and Feeders for 1000 Birds

	Number and type of equipment			
Age Days	Chick Fonts	Automatic Drinkers	Scratch Trays	Tube Feeders
1	10	-	15	-
4	10	3	15	4
7	5	5	10	15
11	-	7	5	18
14	-	8	-	20
18	-	9	-	25
21	-	10	-	30
8 weeks	-	11	-	30
20 weeks +	-	12	-	30

Source: Livestock Services Cooperative Society

Feed is indispensable in the production process and requires proper attention. Different types of feed are made for a particular stage of broiler development. The notable types include starter, grower and finisher. The feed is provided through feeding troughs or tubes. Optimal output requires that sufficient feed is provided to birds at every stage of their development. This is done to avoid waste and requires a strict feeding regime as shown in table 2.4.

Table 2.4: Quantity, Type of Feed and Duration to Feed Broilers

Type	Age Days	Consumption per bird	100 Birds	300 Birds	500 Birds
Starter	0 – 21	1000g	2 bags	6 bags	10 bags
Grower	22 – 32	1500g	3 bags	9 bags	15 bags
Finisher	32 – 42	1600g	3.2 bags	9.6 bags	16 bags
Totals	0 – 42	4.1kg	8.2 bags	24.6 bags	41 bags

Note: 1 bag is equivalent to 50 kilogram of feed

Source: Livestock Services Cooperative Society

The current broiler chicken market is characterized by younger chickens of six weeks. This is due to consumers' preference, and is a fast food chain requirement for tender chicken. The preferred market dressed average weight of the broiler ranges between 1.1 to 1.3kg (Ndiyoi, Chikazunga and Muloongo 2008). However, live weight of broilers at six weeks is expected to be 2 kg. Supermarkets are a market channel that is increasing in importance compared to open markets and other outlets as consumers have become sensitive to food safety issues.

2.4 Layer Production

Egg production stands at 1.45 million eggs per day or 43.5 million eggs per month giving a consumption of 3.38 eggs per person per month or 41eggs per capita consumption per person (Ngosa 2012). This sector is dominated by large scale producers who constitute 70 percent of the total layer production. The day old chicks are mainly produced and supplied by Hybrid Poultry Farm and Bokomo.

Production of eggs at small commercial enterprises is mainly done in a deep liter system. This is an intensive layer system where layers are kept indoors. A layer of 20 cm fresh litter is put on the floor, similar to the broiler houses. The number of birds per square meter floor space depends on the size of the unit and the breed of layers. In a deep litter

system, communal or single nests may be used for egg laying. Communal areas have an area of at least 0.015 square metres per layer and one single nest is suitable for four to six layers. In the deep litter house, feed is placed in troughs or tube feeders. The required feed space is about 6 cm per bird and drinking water is provided in troughs or water fountains. For drinking troughs, 1.5 cm linear drinking space is required per bird (LSCS 2007). The production process requires simple equipment that is cost effective including water dispensers, feeders, laying nests and debeakers.

The profitability of egg production depends on the quality of the day old chicks as well as the quality of pullet management and eventually layers. It is important to ensure that a good environment is provided for raising layers and that vaccinations are given to chicks at the right time. Feed and water provision is critical for raising pullets. Clean water must be provided at all times. The feeding regime usually follows the traditional way of providing starter, grower, developer, and layer mash from point of lay to culling. It is important that adequate feed is provided according to the feeding regime recommendation by the hatchery that supplies day old chicks (Table 2.5).

Hens start laying eggs at 20 weeks old, though there could be a few eggs laid from 17 to 20 weeks. The period of laying eggs extends up to week 56, hence providing 36 weeks of continuous income inflow. The egg size at the beginning of production is usually small and increase gradually and attain 40 grams weight at about 40 weeks. The size of the egg is influenced by the rate of increase in light hours and intensity. Too rapid a rate will force the layers to produce big eggs that results in prolapses or the chicken being egg-bound in the uterus. A good hen of most breeds is expected to lay about 300 eggs in a 12 month laying period and about 340 in a 14 month period (LSCS 2007).

Table 2.5: Type and Amount of Feed Fed to Birds at a Given Age

Type of feed	Age of bird	Feed Consumption
Pullet Starter	0 - 8 weeks	1.764 kgs/bird
Pullet Grower	9 - 14 weeks	4.081 kgs/bird
Pullet Developer	15 - 20 weeks	1.743 kgs/bird
Layer Mash, supreme 96	20 - 35 weeks	110-120 g/day/bird
Layer Mash Supreme 105	36 - 55 weeks	110-120 g/day/bird
Layer Mash Supreme 115	56 – Culling	110-120 g/day/bird

Source: Livestock Services Cooperative Society

Apart from feed and water provision, attention must also be paid to sanitation, hygiene, lighting and light intensity levels. Vaccinations, debeaking and all the necessary activities must be carried out according to recommended practices to avoid mortalities as well as cannibalism. Attention must also be placed on hens when the egg laying starts so that the poor layers are culled to avoid poor returns on feed costs. Additionally, proper management demands that notable characteristics exhibited by good or poor laying hens are easily identified through observation of the comb, abdomen, vent and feathers of the layers.

Eggs just like broiler meat have two market channels of getting to the consumer and these are supermarkets as well as the traditional informal markets. The informal market is a window that is dominated by small scale producers and supermarkets are dominated by large and mostly vertically integrated firms.

2.5 Poultry Stock Feed Industry

The feed industry is one of the most important support industries for both layer and broiler enterprises. The growth of this industry both in quality and quantity of poultry feed produced is another milestone that has increased the growth sustainability of the poultry industry. The potential for commercial livestock feed production capacity is estimated at 450,000 metric tons per year. Currently, the poultry feed industry is producing 18,000

metric tons of commercial feed per month or 216,000 metric tons per year. The bulk of this production is supplied by National Milling, Tiger Animal Feeds, Olympic Feeds, Novatek and Nutri Feeds. Other smaller suppliers include: Quality Feeds, Hi-pro, Simba, CMR and Wonder Feeds Milling in the eastern province of Zambia. In addition, several commercial farmers manufacture their own feed as nutritional consultancy services are available in Zambia.

2.6 Marketing of Poultry Products

The market structure for poultry products in Zambia can be generally described as occurring in two distinct segments namely open/informal and formal markets. The number and size of participants vary distinctively in these market systems.

The informal market is predominantly for small scale producers and involves the sale of live chickens and unpackaged and ungraded eggs. Throughout the country, this system is predominantly found within municipally run markets in all urban and pre-urban centres. The sale of live chickens is still a significant channel for broilers in Zambia, contributing more than 30 percent of broiler meat sold annually. There are many producers who supply this market usually with rudimentary supply chains. Each producer is small in relation to the entire market supply and it is important to note that no producer has any advantage over the others. Entry into this market is easy and most producers enter and exit the market without any difficult. However, with the changing trends in food retailing and lifestyle, the demand for live chicken is slowly declining as most consumers prefer to shop in well-developed formal markets such as supermarkets and mini markets. The demand for eggs in this market is relatively high and is supplied by small scale producers. Just like

broilers, there are many egg producers supplying the informal market and no single producer has the power to influence the market in any way.

The second type of market system is well developed, modern and dominated by a few but large producers that have the capacity to process their products. The main market channels for this system include supermarkets and mini-markets. This market system has a well developed logistics system and has invested in refrigeration, transportation and human resources. The participation of small scale producers in this market is limited to only a few whose participation is purely through contract farming by processors. Because of this, the participation of small producers in this market system is limited to areas surrounding the capital Lusaka due to the location of processing facilities. All but one processing facility is located in the Lusaka Province. This means that only small scale farmers located in these geographical areas are able to engage in contract production and participate in the developed market system. The suppliers of this market are few but have huge economies of scale both for broiler meat as well as table eggs. For this market structure, it is clear that a single producer has the power to affect or influence the entire market system

Out of the total number of broilers produced annually, 65 percent of the broilers are sold dressed, while the live bird market (dominated by small scale producers) takes up 35 percent (Ndiyoi, et al. 2007). The market demand for high quality standards and consistency in production remain the two primary constraints affecting small scale broiler producers' entry and participation in the table chicken market. Most of the eggs produced by large scale enterprises are processed, packed and graded and found their way into supermarkets or mini markets such as Zambeef outlets.

Entry into the developed market is difficult for many small scale producers due to entry barriers of quality standards, volume consistency and safety measures. Most participants in the developed market for poultry products are large producers that enjoy large economies of scale. The market has been dominated by a few large producers, most of whom are vertically integrated. The main participants in this market have access to production and processing technology, advanced distribution systems and a highly skilled labor force. The capital requirements for serving this market are very high as it requires large investment in high tech production, processing and distribution systems and this explains why a few large producers dominate this market channel. However, there is growing demand for processed poultry products by consumers compared to unprocessed ones thus future investment that are tailored to serve this market system has the potential to offer a good return on investment.

CHAPTER THREE: LITERATURE REVIEW

Production, processing and marketing of poultry products is a well-recognized commercial enterprise world over. In Zambia, the poultry industry is one of the agricultural sub-sectors that has seen significant investment and enjoyed sustained growth since the economy was liberalized in 1993. The contribution of the industry to agricultural GDP is 4.8 percent and livestock value added is 48 percent. Poultry is the primary meat consumed in Zambia accounting for an estimated 50 percent of total meat consumption followed by beef at 28 percent, pork and fish together at 16 percent and others at 6 percent (Ngosa 2012).

Investment in the poultry industry has expanded the breeder sector with hatcheries increasing to eight hatcheries with state of the art technology from the initial two before economic liberalization. Despite a decline in 2009, the industry has shown impressive growth with annual growth rates for broiler and layer production estimated at 30 and 20 percent, respectively (Ngosa 2011). The increased investment in infrastructure and capacity has led to a significant increase in the production of day old chicks that has since increased to an annual production of 51 million (Ngosa 2012). For layers, day-old chicks are supplied mainly by the Hybrid Poultry Farm and Bokomo. In addition, the importation of chicks for layers has been reduced to approximately 10 percent, with the largest consumer of imported day old layer pullets being Golden Lay Farm. The estimated number of eggs produced during the same period is at more than 520 million eggs with table and fertile eggs being exported to the Democratic Republic of Congo, Kenya and Tanzania. According to Ngosa (2012), "the broiler sector is dominated by small enterprises that constituent 60 percent of total production while for layers small scale production accounts

for only 30 percent of total production". FAO estimates an annual consumption growth rate of 6.3 percent for both broiler meat and egg production between the period 1990 and 2000 (Chilonda 2005).

Private investment in poultry infrastructure has improved capacity in feed production, production of day old chicks and increased output in processed chicken meat. Table 3.1 shows the existing feed manufacturers, breeders and chicken processors in the country.

Table 3.1: Feed Manufacturers, Breeders and Processors in Zambia

Feed Manufacturers	Breeders	Processors
National Milling	Hybrid Poultry Farm	Crest Chicken
Tiger Animal Feeds	Ross Breeders Zambia	Eureka Chicken
Olympic Feeds	Bokomo Zambia	Country Choice Chicken
Novatek (Zambeef)	Progressive Poultry	Zamchick (Zambeef)
Nutri Feeds	Zambian Poultry Breeders	
Quality Feeds	Panda Hill Hatchery	
Hi-Pro	Chipata Hatcheries	
Simba	Chick Masters	
Wonder Feeds Milling		

Almost all processing plants are located in Lusaka, with only one in Central province and the implication is that most producers are around these locations. Out of the total number of broilers produced annually, approximately 65 percent of these are sold dressed, while the live bird market (dominated by small scale producers) accounts for 35 percent (Ndiyoi, et al. 2007). Ngosa (2012) estimates that, "for the year 2012, the amount of processed chicken meat per week through the processors is approximately 700,000 broilers per week compared to volumes of production in 2009 that stood at 200,000 broilers per week." The increase in processing capacity has been driven by increased demand for dressed chicken in the country. The drivers for the increased demand for dressed chicken

are attributed to increased quality and safety awareness as well as the shortages and high prices of beef on the domestic market.

The evaluation of an investment in any type of business including the poultry business is important for informed decision making. The basis for making sound investment decisions lies in a well done investment appraisal for determination of economic profitability as well as financial feasibility. The viability of a project can beevaluated using several methods and NPV was chosen based on its simplicity and wide appeal among financial experts and uninitiated (B.Sarpong and Al-hassan 2012). Net present value provides a measure of the net value of the investment in today's dollars, while the internal rate of return provides the farmer with a measure to compare this investment with other investments (Prevatt, et al. 2005). The decision to invest involves committing large sums of money to a project initially while income or benefits accrue over time. Boehlje and Ehmke stress that, "because the benefits of investments are based on future events and the ability to foresee the future is imperfect, it is important to make considerable effort to evaluate investment alternatives as thoroughly as possible" (2007). Economic profitability analysis is paramount in selecting a project that is capable of providing desirable financial results. Economic profitability analysis is critical and requires a thorough evaluation as it is the basis for investment decision making. The purpose of an economic profitability analysis is to determine whether the investment will contribute long run profits to the business.

Although various techniques can be used to evaluate alternative investments such as the payback period and internal rate of return, the most commonly accepted technique is net present value, otherwise known as "discounted cash flow" (Boehlje and Ehmke 2007).

Net present value recognizes an important financial principle known as the "time value of money" which is: *a dollar today is worth more than a dollar tomorrow*. The time value of money occurs because a dollar today can be invested to generate earnings in terms of profits, capital gains or interest. Additionally, the uncertainty of receiving a dollar in the future and inflation makes the future dollar less valuable than if it were received today (Boehlje and Ehmke 2007). Therefore, using the correct methodology in appraising a project for investment is a prerequisite for any successful venture as it provides a foundation for quality decision-making and is used as a key factor for making an investment decision.

CHAPTER FOUR: CONCEPTUAL MODEL

The goal of every investor is to maximize the profit of an investment; hence it makes sense to use tools that help to make a credible investment decision. The resources attempt to satisfy unlimited human needs so whenever investment decisions are made, prudence in the allocation of resources to a project must be exercised. The choice of a project for investment is primarily based on the economic profitability of the project. Additionally, understanding the financial feasibility of a project is critical for enhanced management of future cash flows especially for covering expected future obligations. In addition, basing the investment on available capital is critical to ensure that considerations are made within the scope of limited resources.

In practice, there are three traditional methods of evaluating investment proposals namely the Discounted Payback Period method (PP), the Net Present Value method (NPV) and the Internal Rate of Return (IRR). The advantage of these methods is, first of all, simplicity and explicit interpretation of the results. All three methods use projected cash flow that is discounted according to the time value of money.

4.1 Payback Period (PP)

The payback method may be used because it is an easy way to communicate project profitability. This measure is easy to understand and interpret especially if time is of the essence to the investor. A project's payback period is found by counting the number of years it takes before the cumulative discounted cash flow equals the initial investment. The payback rule states that a project should be accepted if its payback period is less than some specified cutoff period (Brealey, Myers and Allen 2011). The decision rule for this method is to accept any project that is capable of paying back the initial investment within a given

period of time. To ensure that cost of capital is taken into account in determining the value of the project, the cash flow can be discounted before computing the payback period and thus called the discounted payback. The discounted payback answers questions such as how many years does the project have to last for it to make sense in terms of net present value? With this in mind, the computation of the payback period for this study was done discounting the cash flows at a rate of 25 percent. The use of discounted payback is important as it does not accept any project with a negative net present value (NPV).

The method focuses on how rapidly the project pays back its initial investment, hence the cutoff date becomes the major determining factor in decision making. The method however ignores all cash flows occurring after the cutoff period. Recognizing the limitations of this method, this study used discounted payback method as an indicator for short-term profitability and also for the purposes of informed discussions and not for economic profitability evaluations.

4.2 Net Present Value (NPV)

Net present value is a financial model that calculates the net value of a project today by discounting future cash flows over the lifetime of a project by an opportunity cost of capital. The time value of money is the most basic concept of net present value and is the most recognized application of the basic principle of finance: *a dollar today is worth more than a dollar tomorrow.* A dollar in hand today can be invested to generate earnings in terms of profits, capital gain or interest. Additionally, the uncertainty of receiving a dollar in future and inflation make the future dollar less valuable than if it were received today (Boehlje and Ehmke 2007). The time value of money is taken into account by the discount

factor which measures the value of $1 today that is received in future and is expressed as a reciprocal of 1 plus a rate of return (r):

$$\text{Discount factor} = \frac{1}{(1+r)}$$

The discount factor is a critical concept in NPV analysis and is often determined using the opportunity cost of capital. The recognition of opportunity cost of capital is important as this is a return foregone by investing in a chosen project with similar risk rather than investing in other projects or in financial markets. The opportunity cost of capital is the standard of profitability that is used to calculate how much the project is worth. It is the expected rate of return offered by other assets/projects with the same risk as the project being evaluated. The analysis of NPV is based on the forecasted cash flow of a project under consideration and is applicable for both single cash flows as well as for a stream of cash flows extending over a number of years. For NPV analysis, only cash flow is relevant. Cash flow is estimated on an incremental basis and consistency is required in the treatment of inflation (Brealey, Myers and Allen 2011).

The rule for adding present values for a stream of cash flows is simple summation because present values are all expressed in current dollars. Below is an illustration of the total present value for a discounted cash flow of a project:

$$PV = \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \ldots\ldots\ldots\ldots + \frac{C_T}{(1+r)^T}$$

This formula can be expressed in shorthand as:

$$PV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

where ∑ refers to the sum of the series, C is cash flow, r is discount rate and t is the time period in years. To find the net present value (NPV), the initial cash flow (initial investment which is usually negative) to the present value of a discounted cash flow:

$$NPV = C_0 + PV = C_0 + \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

where C_0 represents the cash flow at time 0 (today). C_0 is a cash outflow hence bearing a negative sign. The decision rule for Net Present Value is to accept investments that have a positive net present value (Brealey, Myers and Allen 2011).

4.3 Internal Rate of Return (IRR)

An investment should only be made when the project to be invested is worth more than its cost and this is the basis for NPV. The internal rate of return is simply the discount rate that makes NPV equal to zero. The decision rule for IRR is to accept an investment in a project if the opportunity cost of capital is less than the internal rate of return (Brealey, Myers and Allen 2011). Internal rate of return and net present value analyses are very comparable because if the opportunity cost of capital is less than IRR, then the project has a positive NPV when discounted at the opportunity cost of capital. It is imperative to be mindful of the pitfalls that come with IRR to use it correctly.

The discount rate used in this project was reached at by calculating the discount rate offered for investing in government securities. The Bank of Zambia provides the formula for calculating discount rate for investing in government securities and is as shown below:

$$\text{Discount Rate} = \left(\frac{F - P}{F} \right) \times \frac{D}{n} \times 100$$

where F is the Face Value, P is the Purchase Price (cost), D is the Number of Days in a year (365), and n is the Maturity Period of Investment.

Prices are usually quoted in multiples of KR5,000 equivalents to US$1,000 for all transactions (BOZ 2008). Using the above formula, the calculated discount rate is 19.6 percent; however for the nature of the investment under consideration, the risk is higher than government securities hence a discount rate of 25 percent is arbitrary used for the NPV analysis.

4.4 Scenario Analysis

Whenever a cash-flow forecast is made, it is important to discover what else can happen besides the expected. Scenario analysis is critical in determining the riskiness and viability of a project. Since the cash-flow forecasts depend on production and market assumptions, it leaves room for uncertainty. It is important therefore to make alternative assumptions to see how they can affect the viability of the projects under consideration. This provides a good picture of a project if expected conditions do not occur. Those conditions may be a mixture of expected and unexpected causing a project to over- or under perform. A concern for any investment is the likelihood that a given project significantly under performs as this may defeat the profitability of investment. To reduce uncertainties surrounding the project's performance, scenario analysis is used to assess the effects of different scenarios on the NPV, IRR and Payback Period.

CHAPTER FIVE: METHODS

This study used net present value and other tools in determining the economic profitability of both broiler and layer enterprises. The discounted Net Present Value (NPV) was used in the study to determine the economic profitability of each enterprise under consideration. NPV recognizes the time value of money and uses the forecasted cash flows of the project and the opportunity cost of capital commonly known as discount rate. The decision rule for NPV is to accept investments that have positive net present values. This rule was applied in making recommendations as to whether the enterprise is viable for investment. To have another view of the enterprise's attractiveness, the internal rate of return (IRR) that has roughly the same theoretical basis as NPV, was used in the analysis. For the IRR method, the decision rule is to accept investments that offer rates of return in excess of their opportunity cost of capital. The opportunity cost of capital used in the analysis was calculated from a formula provided by the Bank of Zambia for investing in government securities. Considerations were made with regard to the actual discount rate used in this study to account for the higher risk of poultry enterprises compared with government securities.

The focus of the analysis was on small scale commercial production enterprises and the amount for investment was determined by the stipulated amount for small scale enterprises defined by Zambia Development Agency (ZDA). According to ZDA (2012), a "small scale enterprise shall be any business enterprise registered with the Registrar of Companies, whose total investment, excluding land and buildings should be between US$30,000 and US$50,000". For purposes of this study, a US$50,000 initial investment was used for the analysis. The US$50,000 covered capital investment as well as initial

production costs. The major cost components of the capital investment include brooder house construction and production equipment while the production cost covers inputs, labour, electricity, transport and marketing among others.

The data used in this study were collected from the Poultry Association of Zambia (PAZ), Central Statistical Office (CSO), and Livestock Services Cooperative Society. In addition, some data were extracted from ZDA Cost of Doing Business in Zambia Manual 2012 and the other data were obtained directly from the market. Data for costs of inputs, equipment, and the prices of poultry products were collected from the market directly and reflect market prices prevailing in December 2012.

5.1 Assumptions

The currency used in this study is the US Dollar (US$) at the exchange rate of KR5 to US$1. The exchange rate reflects the conversion rate quoted in the Cost of Doing Business in Zambia (ZDA 2012). The assumption made for this study is that land is readily available and that the US$50,000 investment would cover chicken housing construction, production equipment and initial production costs. The government of the Republic of Zambia has set a minimum wage for different categories of nonunionized workers and a monthly wage of US$240 per employee was used in the analysis. For each enterprise, five employees were assumed. It is also assumed that the financing of the project is from savings. It was also assumed that production for broiler enterprise would be staggered in two brooder houses with two weeks allowance for cleaning between each cycle of production. A 3-year tax exemption for any small enterprise as set by the Zambia Development Agency for micro and small enterprises was assumed (ZDA 2012).

5.2 Procedure

The data that were collected from the market and supplemented with the Cost of Doing Business Manual were used in the budgeting process of the enterprises under consideration. Construction of brooder houses was estimated at US $20,000 for the two brooder houses for broiler enterprise and US$15,000 for a single brooder house for the layer enterprise, respectively.

Revenue was estimated from the total number of broilers expected to be sold annually from the broiler enterprise and the number of trays of eggs and culled hens expected to be sold per year. The wholesale prices used in estimating revenue include eggs at US$3.60 per tray, culled hens at US$2.00 per hen and US$5.00 per live broiler chicken. Production costs for each enterprise were derived from the cost of feed, vaccination, day old chick cost, labor, electricity, transport and others (communication and stationery). The total production cost was then expressed as a percentage of revenue by using the annual revenue and production costs.

The production targets for each enterprise were determined by considering a realistic level of production using the US$50,000 initial investment available. Revenue was estimated at mortality rates of 10, 5 and 0 percent respectively for both layer and broiler enterprises. However, the 5 percent mortality rate was used for cash flow forecasting. A straight line depreciation method was applied in the analysis with salvage values estimated at US$20,000 and US$15,000 for broiler and layer enterprises respectively. The economic life of the two enterprises was set at 5 years.

The income statements were estimated for three different scenarios. The NPV and IRR were determined at the discount rate of 25 percent. The discount rate was obtained by

calculating the discount rate that could apply for investing US$50,000 in government securities through the Bank of Zambia. Since money invested in government securities is not prone to the same kind of risk as the one invested in poultry projects, consideration was made to come up with an appropriate rate that was used in the analysis. The calculated rate was 19 percent and this was adjusted upwards to 25 percent for use in the evaluation of the two enterprises.

Microsoft Excel 2007 was used to calculate the enterprise budgets, income statements and to calculate the discounted NPV and IRR based on the cash forecasts. Revenue was estimated to increase at 8 percent annually. A 10 percent tax rate used in the study was obtained from Zambia Revenue Authority (ZRA) and applies to local agricultural enterprises. The 3 years tax free incentive that is provided for new enterprises in priority sectors located in urban areas was also accounted for in the analysis.

5.3 Cost and Production Estimates

The construction of brooder houses was estimated at US$10,000 and US$15,000 for broiler and layer enterprises, respectively. Since broiler production would use two brooder houses, a total of US$20,000 was allocated for construction of brooder houses for the broiler enterprise. The remaining US$30,000 and US$35,000 for broiler and layer enterprises was to cover cost of equipment and initial production inputs. Expenditures on brooder houses and production equipment were treated as capital investment and were depreciated using a straight line method. The major production equipment includes drinkers, feeders, debeakers, heaters and cleaning tools. The total capital investment according to the enterprise budgets were US$27,090 and US$21,095 for boiler and layer enterprise respectively. Table 5.1 documents some key production equipment, unit cost

and quantity requirements for the estimated level of production for broiler and layer enterprises respectively.

Table 5.1: Major Production Equipment Needed for Broiler and Layer Production

Equipment	Quantity Required for Broiler Enterprise	Quantity Required for Layer Enterprise	Unit Cost (US $)
Chick Fonts	50 X 2	40	11.29
Drinkers	50 X 2	40	16.76
Chick Feed Trays	75 X 2	60	3.10
Tube Feeders	150 X 2	100	12.00
Egg Trays (Bundles)	0	150	23.10

Apart from capital investment, there would also be substantial requirements for initial production costs to cover wages, marketing, vaccines, feed, day old chicks, transportation and electricity. Most of the costs that were used in estimating the cost of production were obtained directly from the market with the exception of transportation, marketing, communication and stationery that were extracted from the Cost of Doing Business Manual 2012, a publication of the Zambia Development Agency. Furthermore, the wage rate used in the analysis was obtained from the Ministry of Labour. Table 5.2 presents key inputs that constitute major production costs for broiler and layer enterprises respectively.

Table 5.2: Cost of Key Production Inputs in Broiler and Layer Production

Item	Unit	Unit Cost (US$)
Day old Broiler Chick	1	0.90
Day old Layer Chick	1	1.20
Broiler Starter	50kg	29.20
Broiler Grower	50kg	28.40
Broiler Finisher	50kg	28.00
Pullet Starter	50kg	25.00
Pullet Grower	50kg	23.60
Pullet Developer	50kg	22.60
Layer Mash	50kg	24.00
Gumboro Vaccine	1000 doses	6.00
Lasota	1000 doses	4.00
Vitamin Trace	1 ltr	26.00

The above costs were used to develop enterprise budgets for both broiler and layer production. The two enterprise budgets developed indicate broiler annual production of 60,000 birds and 30,000 trays of eggs equivalent to 900,000 eggs for the layer enterprise. For the broiler enterprise, the production estimate of 60,000 birds annually is expected to be produced from two brooder houses each producing a total of 6 batches per year. Each batch is estimated to produce 5,000 broilers and a total of 12 batches would be produced annually producing 60,000 broiler chickens per year. The layer enterprise generates income from sale of eggs as well as culled layers. The production target for the layer enterprise is set at 30,000 trays of eggs per year from 3,000 hens. The enterprise budgets are presented in tables 5.3 and 5.4 for broiler and layer enterprises.

Using the enterprise budgets, the total production cost was estimated as a percentage of total revenue for each enterprise and increased at the same rate as revenue. The production costs estimates were found to be at 80 and 70 percent for broiler and layer enterprises, respectively. The unit cost of producing one broiler was estimated at US$3.82

while the cost of producing one tray of eggs was US$2.56. These costs were arrived at by dividing the total production cost with the expected output for each enterprise.

Table 5.3: Budget Estimate for Production of 60,000 Broilers per Year

	Unit(US$)	House A (US$)	House B (US$)	Year 1
Number of Birds		5,000	5,000	60,000
Number of Batches		1	1	12
Cash Revenue				
Broiler Birds	5.00			
Mortality rate @ 0 %	5000	25,000.00	25,000.00	**300,000.00**
Mortality rate @ 5 %	4750	23,750.00	23,750.00	**285,000.00**
Mortality rate @ 10 %	4500	22,500.00	22,500.00	**270,000.00**
Production Costs				
Day old chicks	0.90	4,500.00	4,500.00	54,000.00
Feed	2.33	11,650.00	11,650.00	139,800.00
Medication	0.13	625.00	625.00	7,500.00
Beddings	150.00	150.00	150.00	1,800.00
Disinfectants	200.00	200.00	200.00	2,400.00
Electricity	110.00	110.00	110.00	1,320.00
Transport	100.00	100.00	100.00	1,200.00
Marketing	200.00	200.00	200.00	2,400.00
Wages	1,200.00	600.00	600.00	14,400.00
Others(communication,stationery,etc)		941.00	941.00	1,882.00
Total Production Costs		**19,076.00**	**19,076.00**	**226,702.00**
Capital Investment				
Brooder House	10,000	10,000	10,000	20,000
Drinkers				
Chick Fonts	11.29	564.50	564.50	1,129.00
Drinkers	16.76	838.00	838.00	1,676.00
Feeders				-
Chick Feed Trays	3.10	232.50	232.50	465.00
Tube Feeders	12.00	1,800.00	1,800.00	3,600.00
Others(Bulbs, Heaters, brooms, etc)	110.00	110.00	110.00	220.00
Total Capital Investment		**13,545.00**	**13,545.00**	**27,090.00**
Total Costs		**32,621.00**	**32,621.00**	**253,792.00**
Net Income				
Mortality rate @ 0 %		**(7,621.00)**	**(7,621.00)**	**46,208.00**
Mortality rate @ 5 %		**(8,871.00)**	**(8,871.00)**	**31,208.00**
Mortality rate @ 10 %		**(10,121.00)**	**(10,121.00)**	**16,208.00**

Table 5.4: Budget Estimate for Production of 30,000 Trays of Eggs

	Unit cost (US$)	1- 20 weeks (US$)	20 - 52 weeks (US$)	Year 1
Number of Birds	3,000			
Number of egg trays			30,000	
Cash Revenue				
Wholesale price of eggs per tray	3.60			
Sale of culled Birds	2.00			
Revenue @ 0 % mortality rate	3,000	30,000	114,000.00	**114,000.00**
Revenue @ 5 % mortality rate	2,850	28,500	108,300.00	**108,300.00**
Revenue @ 10 % mortality rate	2,700	27,000	102,600.00	**102,600.00**
Production Costs				
Day old chicks	1.20	3,600.00	-	3,600.00
Feed	0.48	11,232.00	38,880.00	50,112.00
Medication	0.15	450.00		450.00
Beddings	150.00	150.00	-	150.00
Disinfectants	200.00	200.00	-	200.00
Electricity	110.00	550.00	770.00	1,320.00
Transport	100.00	100.00	3,200.00	3,300.00
Marketing	300.00	300.00	2,100.00	2,400.00
Wages	1,200.00	6,000.00	8,400.00	14,400.00
Others (communication, stationery & maintenance)	70.00	350.00	490.00	840.00
Total Production Costs		**22,932.00**	**53,840.00**	**76,772.00**
Capital Investment				
Brooder House	15,000.00	15,000.00	-	15,000.00
Drinkers Chick Fonts	11.29	451.60	-	

				451.60
Drinkers	16.76	670.40	-	670.40
Feeders				
Chick Feed Trays	3.10	186.00	-	186.00
Tube Feeders	12.12	1,211.60	-	1,211.60
Others(Bulbs, Heaters, brooms, spade & wheelbarrow)	110.00	110.00	-	110.00
Egg Trays (150 bundles)	23.10	-	3,465.00	3,465.00
Total Equipment Cost		**17,629.60**	**3,465.00**	**21,094.60**
Total Costs		**40,561.60**	**57,305.00**	**97,866.60**
Net Income				
Mortality rate @ 0 %				**16,133.40**
Mortality rate @ 5 %				**10,433.40**
Mortality rate @ 10 %				**4,733.40**

5.4 Scenario Analysis

Net revenue from both enterprises is affected by many factors**.** The factors that would impact revenue include production costs, mortality rates, price of poultry products, market availability for live birds as well as for eggs. The largest component of production costs is the cost of feed for both broiler and layer production. With this in mind, three different scenarios were developed and these are optimistic, expected and pessimistic scenarios. The enterprise budgets formed the basis from which these scenarios were arrived at and projections were made in accordance with these budgets.

The estimated revenue growth rate for the optimistic scenario is 10 percent annually. It was increased by 3 percent from the expected scenario. The growth in revenue may be attributed to increased price of poultry products by 7 percent due to high demand, high product quality and increased management efficiency that would reduce cost of

production by 5 percent. Apart from improved efficiency, reduction in production costs because of lower feed costs or other production inputs could also increase revenue. This scenario used a lower mortality rate of 2 percent that could be attributed to proper management of the poultry production and supply chain system.

The second scenario was the expected scenario. This is the anticipated scenario bearing in mind that all assumptions occur. This scenario assumed growth in revenue of 8 percent, slightly above the current inflation rate of 7 percent. The mortality rate under the expected scenario was 5 percent, slightly higher than the 3 percent in the industry. The enterprise budgets presented in tables 5.3 and 5.4 provide details of expected revenue and production costs. Using production costs as a percentage of revenue, the broiler enterprise budget shows 80 percent of total revenue to cover the cost of production. The layer enterprise on the other hand indicates a 70 percent of total revenue to cover production cost. The experience that comes with enterprise establishment would also increase production efficiency.

The pessimistic scenario considered revenue growth of 5 percent, 2 percent below the anticipated inflation rate. This scenario sets a higher mortality rate of 10 percent. Feed is the largest component of production costs and this scenario anticipates a rise in cost of feed that could drive the production cost up by 10 percent annually. Table 5.5 shows the summary of the assumptions for each scenario.

Table 5.5: Summary of Assumptions made for Optimistic, Expected and Pessimistic Scenarios

	Optimistic Scenario	Expected Scenario	Pessimistic Scenario
Revenue growth rate	10%	8%	5%
Discount rate	25%	25%	25%
Mortality rate	2%	5%	10%
Tax rate	10%	10%	10%
Broilers production cost	75%	80%	90%
Layers production cost	65%	70%	80%

The results of the analysis are discussed in the following chapter. The key factors for which each enterprise was evaluated on for economic profitability include the discounted NPV value and IRR. The NPV and IRR rules were applied in making assessments as to the degree of attractiveness of the two enterprises.

CHAPTER SIX: ANALYSIS

The calculations were done using Microsoft Excel 2007. The discounted payback period was calculated to establish the number of years each enterprise would take to pay back its initial investment. The results presented in table 6.1 show that the layer enterprise would pay back in 3 years compared to broiler enterprise that needs a minimum of 2 years. At first glance, the broiler enterprise looks more profitable than the layer enterprise. The summary of the results obtained from the discounted payback period analysis are presented in the table below.

Table 6.1: Discounted Payback Periods for Broiler and Layer Enterprises

	Discounted Cash Flows				Discounted Payback Period (Years)	NPV at 25%
Year	0	1	2	3		
Layer Enterprise	$(50,000.00)	$25,992.00	$22,457.09	$19,402.92	3	$17,852.01
Broiler Enterprise	$(50,000.00)	$45,600.00	$39,398.40		2	$34,998.40

Additional calculations for the NPV and IRR were also calculated using Excel 2007. NPV calculations used a constant discount rate of 25 percent, a tax rate of 10 percent for income generated by the business and 35 percent for disposal of brooder houses after the 5-year economic life of the projects. The cash flows were forecasted using the enterprise budgets presented in tables 5.3 and 5.4 under the assumptions described in the expected scenario. The results for broiler enterprise are presented in table 6.2 while table 6.3 shows the results for layer enterprise.

Table 6.2: Net Present Value for Broiler Enterprise for a Period of 5 Years

				Tax rate on income from sale of brooder house				35%		
Initial Investment	$ 50,000.00		Discount Rate	25%		Tax rate on Farm Income	10%	Production Cost	80%	
Income Statement										
Growth in Revenue	8%									
Year	0		1		2		3		4	5
Revenue		$	285,000.00	$	307,800.00	$	332,424.00	$	359,017.92	$ 387,739.35
Production Cost		$	228,000.00	$	246,240.00	$	265,939.20	$	287,214.34	$ 310,191.48
Depreciation		$	-	$	-	$	-	$	1,418.00	$ 1,418.00
Profit		$	57,000.00	$	61,560.00	$	66,484.80	$	70,385.58	$ 76,129.87
Tax		$	-	$	-	$	-	$	7,038.56	$ 7,612.99
After Tax Profit		$	57,000.00	$	61,560.00	$	66,484.80	$	63,347.03	$ 68,516.88
Operating Cash Flow		$	57,000.00	$	61,560.00	$	66,484.80	$	64,765.03	$ 69,934.88
Investment	$ (50,000.00)									$ 13,000.00
Net Cash Flow	**$ (50,000.00)**	**$**	**57,000.00**	**$**	**61,560.00**	**$**	**66,484.80**	**$**	**64,765.03**	**$ 82,934.88**
NPV	**$122,742.47**									
IRR	**118%**									

Table 6.3: Net Present Value for Layer Enterprise for a Period of 5 Years

			Tax rate on income from sale of brooder house			35%
Initial Investment	$ 50,000.00	Discount Rate	25%	Tax rate	10%	Production Cost	70%
Income Statement						
Growth in Revenue	8%					
Year	0	1	2	3	4	5
Revenue		$ 108,300.00	$ 116,946.00	$ 126,321.12	$ 136,426.81	$ 147,340.95
Production Cost		$ 75,810.00	$ 81,874.80	$ 88,424.78	$ 95,498.77	$ 103,138.67
Depreciation		$ -	$ -	$ -	$ 1,218.92	$ 1,218.92
Profit		$ 32,490.00	$ 35,089.20	$ 37,896.34	$ 39,709.12	$ 42,983.37
Tax		$ -	$ -	$ -	$ 3,970.91	$ 4,298.34
After-tax Profit		$ 32,490.00	$ 35,089.20	$ 37,896.34	$ 35,738.21	$ 38,685.03
Operating Cash Flow		$ 32,490.00	$ 35,089.20	$ 37,896.34	$ 36,957.13	$ 39,903.95
Investment	$ (50,000.00)					$ 9,750.00
Net Cash Flow	**$ (50,000.00)**	**$ 32,490.00**	**$ 35,089.20**	**$ 37,896.34**	**$ 36,957.13**	**$ 47,653.95**
NPV	**$ 49,260.26**					
IRR	**65%**					

The results from the broiler enterprise show a positive NPV of US$122,742 and IRR of 118 percent. The layer enterprise also shows a positive NPV of US$49,260 with IRR of 65 percent. The positive NPVs are a sign that both projects are economically viable for investment. Positive NPV indicates that a project is economically profitable, hence attractive for investment. Secondly, the results for both broiler and layer enterprises show internal rates of return in excess of 25 percent opportunity cost of capital used in the analysis. According to the decision rules for both NPV and IRR, the projects evaluated in this thesis can be accepted for investment as they are seen to be economically sound for prudent investment.

Calculations of NPV and IRR under different scenarios also showed positive NPVs and IRR in excess of 25 percent. Table 6.4 summarizes the results for the optimistic, expected and pessimistic NPVs and IRRs for broiler and layer enterprises respectively.

Table 6.4: NPV and IRR for Optimistic, Expected and Pessimistic Scenarios

	Optimistic Scenario	Expected Scenario	Pessimistic Scenario
Broiler NPV	$ 178,242.48	$ 122,742.47	$ 30,550.13
Broiler IRR	154%	118%	51%
Layer NPV	$ 72,260.90	$ 49,260.26	$ 11,185.91
Layer IRR	81%	65%	35%

The analysis under different scenarios shows that the NPV for the two enterprises are positive and the IRRs are in excess of 25 percent (Table 6.4). This shows that the enterprises are economically profitable for investment according to the decision rules for both NPV and IRR. The broiler enterprise is more attractive across all scenarios than the layer enterprise. According to the results, it can be said that broiler enterprise is more

attractive for investment than layer enterprise as it provides more dollars in return on each dollar invested.

A simple sensitivity analysis shows that changes in cost of feed have a huge impact on the overall cost of production indicating that cost of production is sensitive to changes in the cost of feed. For instance, 10 percent increase in cost of feed increases production cost by 5 percent in the layer enterprise and 4 percent in broiler enterprise. Increasing the cost of transport and electricity by 10 percent only increases total production cost by 1 percent in layers and a negligible increase in the overall cost of production for broiler enterprise. Additionally, the revenue is equally sensitive to sharp drop in market prices of chicken meat though this does not pose a danger to the enterprises because the prices of poultry products on the market have remained relatively stable for more than a decade. If revenue remained static for the period of 5 years while costs increased at 8 percent annually, the results show the NPV of $12,606 and IRR of 40 percent for layer enterprise while for broiler enterprise, the results indicate the NPV of $26,284 and IRR of 70 percent.

A break-even analysis was also conducted on the enterprise budgets presented in tables 5.3 and 5.4 at 5 percent mortality rate and zero tax rates. The results showed that the break-even price for broiler enterprise is US$4.49 per broiler for the production of 60,000 birds annually. Since the quantity produced affects both revenue and cost of production, it was found that a production of 39,213 broiler birds annually or producing 3,268 birds per batch can also break even. For layers, the breakeven price is US$3.20 per tray of eggs while selling culled hen at US$2.00 and the breakeven quantity is 25,605 trays of eggs. This is the minimum number of egg trays that is needed to cover all costs if sold at the

wholesale prices used in budget. It was also found that all costs can be covered by the sale of eggs at US$3.43 per tray of eggs without accounting for culled hens.

It was also interesting to note that the production cost of the layer enterprise as a percentage of revenue was lower than the production cost of broiler enterprise. A close look at the two costs of production indicate that about 65 percent of total production cost is spent on feed for layers compared to 60 percent for broiler enterprises. In addition, day old chicks for the broiler enterprise make up 25 percent of total production cost compared to 4.7 percent for layers. Items such as disinfectants, beddings and medications contribute substantially to the high cost of production in broiler production compared to layer production. This is because in broiler production every production cycle requires new beddings, disinfectant and the cumulative use of medication. Broiler production was found to be more lucrative than layer production for investment.

In addition, the broiler enterprise has the quickest income generation period and provides income at a specific short time interval. Unlike layers, broilers take 6 weeks to complete one production cycle and just require two weeks for cleaning and sanitation between successive cycles. The management of flocks is relatively easier in broilers than in layers. On the other hand, layers take a minimum of 20 weeks before stable income begins and it provides steady and continuous cash inflows that last for 32 to 48 weeks in one production cycle. Layer enterprises on the other hand provide income from two streams: eggs, as well as the sale of culled hens for meat. It is also important to note that once broilers are ready for the market, they have to be sold immediately as any delay may result in increased costs of production resulting from increased feed intake.

The market for poultry products is available in Zambia and other countries. The poultry products can be supplied to fast foods outlets, hotels, lodges, households through open markets and formal markets and can be exported to the wider market in the region. However, the majority of small scale farm enterprises target household consumers through open markets. The risk that small scale enterprises are faced with is the lack of a guaranteed market and price whenever product is taken to the market. Sometimes it becomes a cost for producers to keep feeding broilers that have already reached the market weight if they cannot be sold at once.

Since the broiler enterprise is more attractive in terms of economic profitability than the layer enterprise, this could be seen as a possible explanation as to why many small scale producers prefer investing in broilers other than layers. In addition, the quick cash inflow, lower management requirement and the lower feed cost per production cycle play an important role in influencing many small scale farmers to engage more in broiler production other than layer production.

CHAPTER SEVEN: CONCLUSION

The poultry industry is a well recognised sector of the economy in Zambia. It currently contributes 4.8 percent to agriculture gross domestic product (GDP) and 48 percent to the livestock sector. The production capacity of stock feed, day old chicks and output for layers and broilers has increased significantly since the 1990s. Production of broiler meat increased from 19,000 tonnes in 1990 to 72,000 tonnes by 2011. Similarly the egg output also increased significantly from 25,000 tonnes in 1990 to over 60,000 tonnes in 2011. The industry has shown growth in the past years with the growth rate for boiler and layer production estimated at 30 and 20 percent respectively. Poultry meat continues to be the primary meat consumed in Zambia accounting for an estimated 50 percent of total meat consumption followed by beef at 28 percent; pork and fish together account for 16 percent and others at 6 percent. The growth of the poultry industry has been influenced by both demand-side and supply-side factors. Demand-side factors include an increase in population, increased disposable income from the emerging middle class, urbanization and higher prices of beef products. Supply-side factors include advances in breeding technology, improved infrastructure for feed manufacturing and slaughter and processing technologies among others.

This thesis used NPV and IRR tools to evaluate the economic profitability of both the broiler and layer enterprises. The data used in the analysis were obtained from the industry and other data were obtained from the Cost of Doing Business Manual 2012, a publication of the Zambia Development Agency.

The data were used to estimate enterprise budgets for broiler and layer enterprises respectively. The enterprise budget for broiler production estimated revenue from the sale

of broiler chickens at a wholesale price while the layer enterprise budget estimated its revenue from the sale of eggs as well as culled hens. Revenue from the broiler enterprise was estimated at US $5 per bird while the layer enterprise was expected to generate income from sale of eggs at US $3.60 per tray and culled hen at US $2 per hen. In addition, revenue was estimated to grow at a rate of 8 percent annually. The production estimates were set at 60,000 broilers and 30,000 trays of eggs for broiler and layer enterprises annually.

Production equipment and brooder house construction costs were the major capital investment and were depreciated using a straight line method for a 5-year economic life. The total capital investment was estimated at US$27,090 and US$21,095 for boiler and layer enterprises, respectively. The cost of feed was the major component of production costs for both broiler and layer production. The cost of feed constituted about 65 percent of total production cost for the layer enterprise and about 60 percent for the broiler enterprise. The total production cost as a percentage of revenue was estimated at 80 percent and 70 percent for broiler and layer enterprises, respectively. The major components making up production costs include the cost of feed, vaccines, day old chicks, wages, marketing and transportation.

Though the target market assumed for the sale of poultry products in both enterprises is the open market system, there are two well established market systems for poultry products in Zambia. These include the open/informal and the formal market systems. The open/informal markets are predominately run the local councils while the formal markets are run by business executives of national and multinational food chain stores. The council run markets are referred to as informal because most of the market

participants have informal businesses that only have the permit to trade. The second type which is the formal market system uses supermarkets and mini marts as market channels. The small scale poultry producers are the major if not the only producers who supply the open market system. There is little or no value addition to poultry products that are supplied to this market and the supply chain is very short with rudimentary distribution channels. The formal market system on the other hand has well developed supply chain with very organized distribution channels and supply supermarkets and mini marts. This market system is dominated by large producers who are mostly vertically integrated. Though a window of opportunity exists for small scale producers to participate in the formal and developed market system, very little occurs. Small scale producers only participate through contract farming and at the moment only broiler producers located near processing facilities are able to participate. The egg producers on the other hand have a limited chance of participating in the formal supply chain due to low levels of production as well as high demand from its traditional market, the open market. The open market still offers large and attractive market for small scale poultry producers and these are found in municipally run markets throughout the country.

In the analysis, three different scenarios that included optimistic, expected and pessimistic were considered. All scenarios used a constant discount rate of 25 percent and a tax rate of 10 percent. The optimistic scenario used a revenue growth rate of 10 percent, mortality rate of 2 percent and a 5 percent reduction in the expected production cost. The expected scenario used a revenue growth rate of 8 percent and 5 percent mortality rate in addition to the projected production costs. Furthermore, the pessimistic scenario used 5

percent revenue growth rate, 10 percent mortality rate and increased production cost by 10 percent.

The analyses across all scenarios revealed that both broiler and layer enterprises are economically viable as they both showed positive NPVs and IRRs in excess of the 25 percent opportunity cost of capital used in the analyses. The analysis for broiler enterprise showed a NPV of US $178,242 for the optimistic scenario, US $122,742 for the expected scenario and US $30,550 the pessimistic scenario. On the other hand, results obtained from layer enterprise analysis showed NPVs of US $72,388, US $49,260 and US $11,186 for the optimistic, expected and pessimistic scenarios, respectively. In addition, the IRRs for all scenarios were in excess of the 25 percent opportunity cost of capital used in the study. Both enterprises are economically viable for investment. However, the small scale broiler enterprise is more attractive for investment than small scale the layer enterprise as reflected by the NPVs and IRRs of the two enterprises. This explains the investment seen in the Zambian poultry industry where 60 percent of broiler producers are small scale compared to 30 percent involved in layer production.

For actual investment purposes, it must be emphasized that further considerations such as market availability, technical management capabilities and others should be taken into account before investing in any of the enterprises discussed. In addition, for purposes of good risk management and stable cash flow, a mixed investment of the two enterprises may be desirable. Looking at the current market trends, it is important that investment in small to medium processing facilities is taken into account if investment in the broiler enterprise is to meet the needs of future consumers. Contract production system is also another valuable option to think about when producing at a small scale level.

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