

**ENHANCING COMPETITIVENESS OF SMALL SCALE
POULTRY EGG PRODUCTION FARM IN THE
DEMOCRATIC REPUBLIC OF CONGO**

by

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ABSTRACT

The rapidly changing economic environment in the Democratic Republic of Congo (DR Congo) offers significant opportunities for businesses. The food and agribusiness sector is one of the major opportunities for growth given that increasing incomes are going to enhance the food and nutrition security needs of an increasing segment of the population. Animal protein in the form of chicken meat and eggs are relatively inexpensive and offer an opportunity for entry and differentiation in a markets located in DR Congo's largest cities of Kinshasa and Kananga.

This thesis uses the case of Z-CO Farm in DR Congo to explore the strategic opportunities for small-scale egg production in a low-income but growing country. Having been in operation for a number of years, Z-CO Farms has been producing chicken eggs for the general consumer market. This thesis explores the opportunity to differentiate the market that Z-CO Farms targets with the view to enhance its competitiveness, expand the market boundaries and create new value for customers that produce significant rewards. The off-take for the project is the creation of Blue Ocean markets for chicken eggs in a market that is increasingly exposed to food safety risks by assuring consumers a safe product. This project, when implemented, would be the first in DR Congo. However, would it be profitable? Under what conditions would it be profitable?

We employ three primary methods to answer the foregoing questions. First, we evaluate the literature and the available secondary data. Second, we use an economic and financial model to develop the foundation for conducting the analyses for assessing the feasibility of building a small-scale table egg production system to address the emerging higher income consumers in DR Congo. We draw on the blue ocean strategy eloquently presented by Kim and Mauborgne for insight and guidance in building a unique product and service offering for the identified markets in Kinshasa and Kananga. We assess four strategies: the base scenario of the

current market conditions where Z-CO maintains its commodity red ocean engagement in the market; innovating its feeding program for the birds; pursuing a market segmentation program whereby it offers high value food safety value proposition to the middle and upper-middle class of consumers; and a combination of a feed innovation and market segmentation initiative.

The results show that while the first two strategies returned a positive net present value (NPV) in Kananga, they failed in Kinshasa. This is because of the level of competition in Kinshasa compared to Kananga as well as the cost of operations in the two locations. The results also show that while the remaining two strategies were profitable in both markets, they offered higher NPV and internal rates of return in Kananga than in Kinshasa. The best outcome in operating in both cities involved the fourth strategy, producing a combined NPV of about \$493,867. The principal driver for this superior performance in Kananga is cost of feed. There is, therefore, value in thinking about how to leverage this cost advantage in Kananga to enhance the profitability in Kinshasa because of the population and income advantage in the latter.

The study provides insights for the management of Z-CO to pursue their future investment planning and in selecting the locations and size of their operations to maximize their NPV and IRR. It also identifies the principal sources of risks that Z-CO's management must avoid or effectively manage to achieve their desired business outcomes.

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CHAPTER I: INTRODUCTION

With growing urbanization and increasing incomes in Africa, animal product consumption, including chicken eggs, has been increasing. As a result, the local production of table eggs has been increasing. However, the inability of local production to meet local demand has also led to an increase in imports, boosting regional trade as well as international trade in table eggs. The structure of the chicken egg production industry is very simple: it is dominated by highly capitalized, often foreign-owned, large, highly integrated and modern companies with numerous many small-scale producers operating on the fringes. The small-scale producers are generally locally owned, small, unintegrated, and rudimentary in their operations. This structure presents significant opportunities for small-scale producers to demarcate specific market segments that demand specific products that may be difficult for the large producers to address. Thus, the structure of the African poultry industry creates opportunities for significant profit opportunities for small players.

The thesis uses the case of Z-CO Farm in DR Congo to illustrate this strategic opportunity for small-scale egg production in a low-income country. The country presents a big challenge as well as an opportunity for the researchers and potential investors. For example, there is almost no credible scientific research on the poultry sector or on the agricultural industry in DR Congo since the country became embroiled in various civil wars and political instability. However, as a post-conflict country – conflicts that have made it one of the poorest countries in the world – there is significant potential to play catchup on all fronts, including accelerated income growth, consumption and attendant economic growth.

1.1 Background and Case Location

The Democratic Republic of Congo (DR Congo) is one of the largest countries in Africa with a 2013-estimated population of about 67.5 million. Figure 1.1 shows that it is located in central Africa and covers 2,345,000 square kilometers (905,000 square miles). It is

reputed to be probably the most naturally endowed country in Africa. It is the world's largest producer of cobalt ore and a major producer of diamonds and copper.

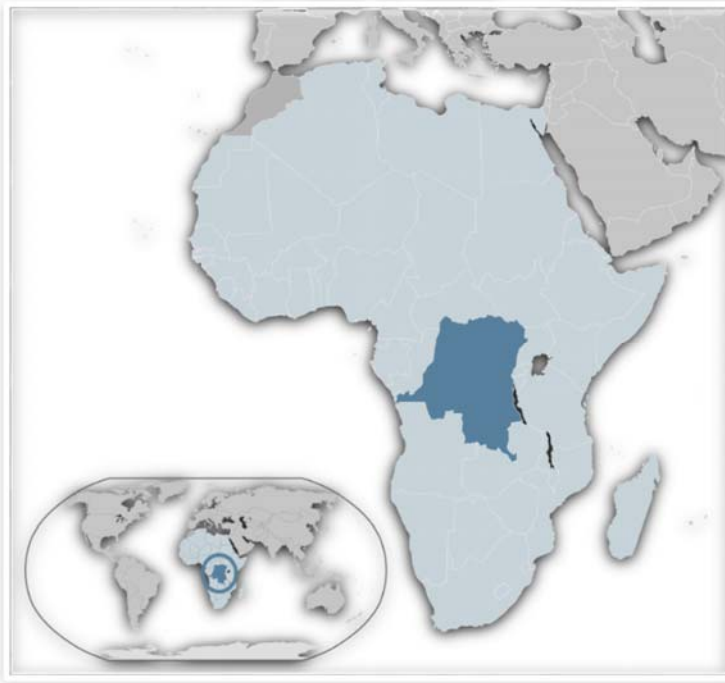
It's surrounded by nine neighbor countries: Angola and Zambia at the South, Tanzania, Burundi, Rwanda and Uganda at the East, South Sudan and Central African Republic at the North, Congo-Brazzaville the West. It has only a small coastal overture at the Congo River mouth (Moanda city), otherwise the country would be completely landlocked.

It is the second largest country in Africa by area (following Algeria) and the eleventh largest in the world. Regarding its population, it ranks fourth in Africa and nineteenth in the world. But with a low population density of 29 per square kilometer, it ranks only 185th in the World and 38th in Africa (while its neighbor Rwanda and Burundi for example have ten times greater density). The Democratic Republic of the Congo is the most populous officially French-speaking country. It has four other official locally-spoken languages – Kikongo, Lingala, Swahili and Tshiluba.

The country has gone through numerous political turmoil in its lifetime and this is reflected in the numerous names it has had since independence. From the Berlin Conference in 1885, when Europe scrambled for Africa and divided it among its colonial countries, until 1908, the country was known as Etat Independant du Congo (Congo Free State), a personal property of the Belgian King Leopold I, neutral regarding all colonial powers of that time. It was handed to the Belgian state only in 1908. From then 1908 until independence in 1960, it was officially Belgian Congo. The first constitution lasted from 1960 to 1964 and its name during that time was Republic of the Congo (Leopoldville). Then it became the Democratic Republic of Congo: from 1964 to 1971, after which it was named the Republic of Zaire from 1971 to 1996. In 1996, after a new peace agreement was reached with a democratic election and emergence of some economic certainty and the name changed to what it is today (and what it was in 1964-1971): Democratic Republic of Congo. The Republic of Congo (Brazzaville),

which is to the West of the Democratic Republic of Congo is a different country and has a very different history from that of Congo DR, despite their proximity and sharing of common tribes along their border.

Figure 1.1: Location of the Democratic Republic of Congo (Dark Blue)



Source: http://commons.wikimedia.org/wiki/File:Location_DR_Congo_AU_Africa.svg

The political instability that has engulfed the country for nearly four decades has contributed to the country's very poor infrastructure. The poor infrastructure has increased the cost of production for virtually every food product in the country as inputs have to be moved and products transported over long distances with poor roads and railroads. Indeed, DR Congo has fewer all-weather paved roads than any other African country of its size. It is reported that its total paved roadways total only about 2,300 km, but only half of this is in good condition (Wikipedia, n.d.). Rail service, like roads, is inadequate. However, it provides some of the predictable means of logistics during the rainy season. There were about 5,200 km of rail in 1995 and only about 4,770 km in 2002. However, there are links to neighboring countries of Zambia and Angola. Angola has plans to connect its Luanda line to Matadi Bridge to provide a

link to its Cabinda Province. This could provide some good access from the port of Matadi to other parts of the country. Because of its natural endowments of rivers, the natural navigation subsystem in the country has been water transport. The main waterway is the Congo with its numerous tributaries throughout the whole country.

1.2 Economic Profile

Most industrial investments in the country have been directed into the mining and mineral sector, starving agriculture of the necessary investments required to modernize this sector of the economy that employs the majority of the country's population. It is sad to note that while DR Congo was the second most industrialized country in Africa at the time of its independence in 1960 (second only to South Africa), it has since become one of the poorest countries in Africa, with a per capita Gross Domestic Product (GDP) of only \$416. It scored 0.338 on the Human Development Index in 2013, putting it at 186th in the world, ahead only of Niger, which scored 0.337 (United Nations, 2014).

Recent macroeconomic indicators clearly point to some recovery from the long years of war and political instability. Gross Domestic Product (GDP) is reputed by the World Bank to be growing on an average above 6% during the decade, reaching even 8.5% in 2013, making it one of the highest in Africa and the World. Similarly, inflation has sharply dropped from decade-long hyperinflation (31% in 2002) to as low as 1.6% in 2013, making easy strategic pricing for all businesses. Like most African countries experiencing these high growth rates and low inflation, the reality on the wellbeing of consumers is not visible yet. Gross National Income (GNI) measured in Purchasing Power Parity and current international currency for DR Congo increased at about 4.4% per annum between 2000 and 2013. The life expectancy at birth is also increasing, rising from about 46.4 years in 2000 to 49.6 years in 2012, an average growth rate of about 0.5% per annum over the period. However, the potential has not been

transformed in real income. But there is evidence that this is happening, albeit not in a uniform manner across the country.

1.3 Research Question

According to International Monetary Fund estimates, GDP per capita has just reached \$484 in 2013, up from \$175 in 2003. This makes DR Congo one of the poorest nations in the World. However, the upward trend in income presents a positive outlook. This is further supported by rising life expectancy, implying an emerging consumer market for higher value products. According to Bennett's Law, increasing incomes lead to a decrease in the proportion of starches in the food basket, with the difference being replaced by animal proteins and animal source products.

Herein lies the opportunity to position and seize the emerging demand for the most basic of animal products – eggs. The research question emanating from this is: Does DR Congo present a feasible market for developing a differentiated profitable chicken eggs production system that would not compete directly with the large, heavily endowed integrated poultry farms? If such a market exists, what strategy should be executed to enhance the probability of success for a small-scale producer?

1.4 Research Objectives

The overall objective of this research is to evaluate the economic feasibility of table egg production in DR Congo, focusing on a market segment that is sensitive to food safety and highly insensitive to price. In other words, the research seeks to determine the economic feasibility of table egg production for a relatively price inelastic demand because of the market segment's cognizance of food safety risks. The specific objectives are as follows:

1. Evaluate the DR Congo market environment to determine the potential for a critical mass of consumers who would appreciate a safe supply of table eggs for which they are willing to pay a premium

2. Develop a model for differentiated eggs production and marketing for a food safety-conscious market segment
3. Conduct an economic and financial analysis of such a differentiated production and marketing model to determine its feasibility and, hence, warrant for investment

1.5 Methods

Three primary methods are employed in this research. First, we evaluate the literature and the available secondary data to address the first objective. Second, we use an economic and financial model to develop the foundation for conducting the analyses for assessing the feasibility of building a small-scale table egg production system to address the emerging higher income consumers in DR Congo. We draw on the blue ocean strategy (Kim and Mauborgne, 2005) to develop a market segmentation and boundary expansion strategy for seizing the identified market and develop a plan to execute the identified strategy.

1.6 Thesis Outline

The next section of this thesis presents an overview of the literature on table egg production, the value of table eggs to human nutrition and the process of building an innovative marketing program. Chapter III addresses the data, assumptions and methods used to conduct the research in more detail. Chapter IV presents the results of the analyses and the marketing strategy for the company in its effort to seize the emerging market for animal protein using table eggs. Execution challenges and ideas about how to overcome such challenges are presented in the final chapter, along with summary and conclusions from the study.

CHAPTER II: LITERATURE REVIEW

This chapter provides an overview of literature on the poultry sector. It is important to recognize that there is little literature on the sector in most of Sub-Saharan Africa mainly because it is not formally developed. The section is divided into three principal segments. The first part covers the production of eggs and the nutritional quality of eggs within the human food system. The second part addresses the market trends in consumption, drawing on literature in other countries that have followed similar development paths as Sub-Saharan Africa for potential indications of the paths that may evolve as the markets in the region and its countries grow and develop. The final segment of the chapter provides an overview of the economic and financial models that are used as well as the foundations of the strategy that is employed to segment the market.

2.1 Chicken Eggs

The freshness, size, shell color and thickness, yolk color and taste determine the different quality of eggs. Eggs are one of the more nutritional food in the world, due to its high concentration in proteins, energy and vitamins (choline), as it appears in Table 2.1. Eggs appear so to be, after cow milk, the cheapest source of protein in US, with around 48 g of protein per dollar (coachcalorie.com n.d.). In comparison, milk rank is the highest at 49.6 g of protein per dollar. But this remains contextual, as unit food cost may vary a lot between countries. In DR Congo for example, where almost all milk is imported, eggs are a cheaper source of protein than milk. The FAO considers eggs as an “inexpensive source of high-quality protein, essential vitamins, and minerals that are needed for a healthy diet and a healthy life” (FAO, World Egg Day 2012 2012).

Table 2.1: Nutrient Data for Cooked Whole Egg

Nutrient	Unit	Value per 100 g	1 Large egg (61 g)
<i>Proximate</i>			
Water	g	76.13	46.44
Energy	kcal	154	94
Protein	g	10.57	6.45
Total lipid (fat)	g	11.66	7.11
Carbohydrate, by difference	g	0.64	0.39
Fiber, total dietary	g	0	0
Sugars, total	g	0.31	0.19
<i>Minerals</i>			
Calcium, Ca	mg	48	29
Iron, Fe	mg	1.48	0.9
Magnesium, Mg	mg	11	7
Phosphorus, P	mg	167	102
Potassium, K	mg	117	71
Sodium, Na	mg	155	95
Zinc, Zn	mg	1.09	0.66
<i>Vitamins</i>			
Thiamin	mg	0.034	0.021
Riboflavin	mg	0.386	0.235
Niacin	mg	0.064	0.039
Vitamin B-6	Mg	0.143	0.087
Folate, DFE	µg	39	24
Vitamin B-12	µg	0.76	0.46
Vitamin A, RAE	µg	172	105
Vitamin A, IU	IU	617	376
Vitamin E (alpha-tocopherol)	Mg	1.29	0.79
Vitamin D (D2 + D3)	µg	1.7	1
Vitamin D	IU	69	42
Vitamin K (phylloquinone)	µg	4.5	2.7
<i>Lipids</i>			
Fatty acids, total saturated	G	3.319	2.025
Fatty acids, total monounsaturated	G	4.843	2.954
Fatty acids, total polyunsaturated	G	2.712	1.654
Cholesterol	Mg	313	191

Source: USDA National Nutrient Database.

These nutritional values of eggs are nevertheless balanced with some health potential risks, as cholesterol. This is mainly due to the content of fat in yolk and lecithin. This led to low cholesterol diets to reduce or eliminate eggs consumption, and they range among middle and high revenue. But more recent research has challenged this thinking. One these studies conducted by Dawber showed that within the range of egg intake by the population, differences

in egg consumption were not correlated to blood cholesterol level or to coronary heart disease incidence (Dawber, Nickerson and Brand 1982). Nakamura concluded that other factors, more important than egg consumption, influence the level of cholesterol (Nakamura, et al. 2006). He suggested that eating eggs normally, up to almost daily, was not associated with an increase in coronary heart disease incidence for middle-aged Japanese men and women. Even if the debate is far to be closed, these scientific evidences came to boost egg consumption in developed countries.

2.2 Egg Production Systems in Developing Countries

Although the fastest growth in egg production is occurring in developing countries, the breeding of layers has been concentrated in developed countries. Another important observation is that the majority of developing countries are in hot climates while the majority of developed countries are in temperate climates. This would suggest the need to begin focusing on specific breeds that thrive in hotter climates since most genetics in these developing countries, including Africa, are imported from developed countries (R.S. Gowe 2008). Dagher describes the detrimental effects of heat stress on poultry and argues that this stress can be reduced through appropriate housing, nutrition and overall management (Czarick III and Fairchild 2008).

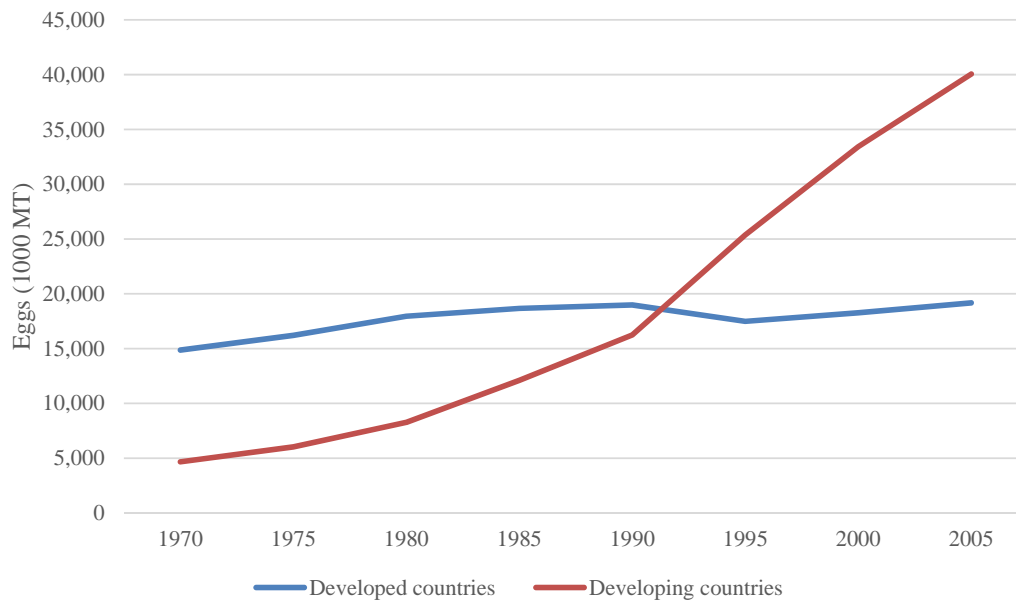
In hot climates, it is very important to keep the bird cool. There is a thermos-neutral temperature zone, roughly around 25°C, which is optimum for birds in heat management. This is important because using energy to manage body heat implies diversion of productive energy, leading to lower bird productivity. This lower productivity results from the natural tendency of hens to reduce their feed intake, which produces a negative effect on their laying productivity. This means that it is critical in hot climates, such as DR Congo, to manage the temperatures of the houses in which the birds are kept to minimize the temperature effect on productivity.

Another physiological factor influencing productivity is body weight (Meunier et al., n.d.). They argue that the ideal body weight for a laying hen is about 3 pounds by age 18 weeks. When the hen weighs less than this at that age, it is very likely that it will cease producing eggs very quickly after it starts producing. This creates significant economic challenges for the producers since the economic levels of production are not achieved and the whole economic life of the bird is drastically reduced. The cause of this body weight risk is the heat in the poultry houses. This emphasizes the need to be very cognizant of temperature in order to ensure and maintain bird productivity.

2.3 Global Egg Production and Consumption

In the last 40 years, production of poultry products (meat and eggs) has increased faster than for beef or pig meat. In 2005, the increase over 35 years was about 436% and 203% for poultry meat and eggs, when it appeared to be only 57% for beef and veal meat (Windhorst 2006). Windhorst shows that the share of developing countries increased from a mere 24% in 1970 to nearly 68% by 2005. This implies that the share of global egg production occurring in developed countries declined from more than 73% to less than 33% within a matter of a quarter century (Figure 2.1).

Figure 2.1: Trend in Egg Production by Developed and Developing Countries



Source: Windhorst, 2006.

The evolution of egg production however is different across regions and between developed and developing countries. Table 2.2 shows the egg production and share of global egg production in 1995 and 2005 across the continents. The table shows that while Africa's share was the smallest among the continents, the growth was second only to that of Asia. Despite this rapid growth, Africa's share of global output declined between 1990 and 2005 from about 4.0% to 3.5%. This implies that there is opportunity for expanding production in Africa to account for the growth in its population (Table 2.3). The table shows that Africa has the lowest per capita egg consumption in the world, and even the South Africa's consumption (the highest of the continent) is below that of other regions' average. What is remarkable and hopeful is that the growth in consumption across Africa is increasing, as expected, because of the increasing incomes and economic progress. This bodes well for the egg production industry across the sub-Saharan African continent because it presents a more positive future for the industry. "Eggs and poultry meat are beginning to make a substantial contribution to relieving the protein insufficiency in many African countries' (Czarick III and Fairchild 2008).

Table 2.2: World Production of Eggs and Distribution across Continents

Continent	1990 (1000 T)	Share	2005 (1000 T)	share	Change
Africa	1420	4.0%	2230	3.5%	+57%
N. & C. America	5790	16.2%	8052	12.6%	+39%
S. America	2310	6.5%	3518	5.5%	+52%
Asia	14270	39.9%	40055	62.5%	+181%
Europe (with former USSR)	11710	32.8%	10035	15.7%	-14%
Oceania	250	0.7%	227	0.4%	-9%
World	35750		64117		79%

Source: FAOSTAT

Table 2.3: Per Capita Egg Consumption by Continent (kg)

Continent / countries	2008	2009	2010	2011	% Change 2008/2011
Africa	3.8	3.6	4.1	4.3	11.8%
Asia	7.7	7.9	8.0	8.0	3.8%
Europe	11.3	11.1	11.0	11.0	-2.1%
European Union	12.4	12.2	12.2	12.0	-3.2%
N. & C. America	14.4	14.5	14.5	14.5	0.9%
Oceania	8.5	8.0	8.1	8.5	-0.6%
S. America	7.7	8.8	9.0	9.4	21.9%
World	8.8	8.8	8.9	8.9	1.1%

Source: FAOSTAT, our calculus.

2.4 Small Scale Poultry Farming

In Africa, chicken production is divided into large-scale and smallholder chicken production, and smallholder production is mainly free-range production (Czarick III and Fairchild 2008, 6), and even without specific housing dedicated to poultry. A significant part of their production is for own consumption. As reported above, this rural and traditional extensive poultry production is estimated to be more than three quarters of the continent's production, following estimates by Gueye (1998).

However, systematic egg production is rare in these extensive rural systems. They have not selected breeds or adequate balanced feed to sustain intensive and specialized egg production farming. Therefore, regular egg consumption is not very common in rural areas, as they are primarily used for continuous poultry reproduction.

It is therefore important to clarify what is “small scale layer farms” in this thesis. These are not rural extensive farming as described above. We refer here to formal farms, structured as small business unit, managing their egg production for selling in the market. They are distinguished from large-scale farm units mainly by the number of hens (less than 20,000) and nature of equipment used for breeding (Table 2.4).

Table 2.4: Characteristics of Large and Small-Scale Poultry Farms in Africa

	LARGE SCALE FARMS	SMALL SCALE FARMS
<i>Common characteristics</i>	Market oriented eggs production	
	Selected breeders for eggs production	
<i>Points of difference</i>		
<i>Size</i>	More than 20,000 hens and usually more than 50,000	Less than 20,000 hens (very small having less than 3,000)
<i>Housing system</i>	Modern cages with automatic drinkers and feeders systems	On ground and wood shaving litter or refurbished and manual cages
<i>Management</i>	Skilled management, with veterinary on site	Family management, with irregular veterinary consult
<i>Feed sourcing</i>	In-farm made feed, or supplied with contractual supplier (integrated)	Feed used bought from various manufacturers (less integrated)

Source: Author.

These small and medium farms play an important role in alleviating poverty and generate revenues for all stakeholders, as they are more labor intensive and use women for marketing their products. Sonaiya (1993) explains that “...there are two options for poultry development in Africa. One is to attempt to increase large-scale intensive poultry production to respond to the urban demand. The other is to look at new channels for developing small and medium scale semi-intensive poultry production to serve both the urban and rural populations. Where possible, the two options should be pursued simultaneously.” This advice is explored in this thesis.

2.5 The Feed Formulation Dilemma

Klein (2013) presents some interesting nutritional and feeding solutions for the African poultry industry, distinguishing between “price” and “cost” of a feed. With the cost of feed, he includes the effect on laying quality and capacity. A feed can be priced less and cost much

more, if improperly balanced. Klein, therefore, stresses the critical factors that contribute to efficient feeding, and gives useful guidelines for choosing alternative feed ingredients and formulation.

In attempts to reduce feed cost in Africa, many studies focus on replacing expensive imported sources of protein with locally available ingredients, some as revolutionary as using termites as protein source in poultry feed (Farina, Demey and Hardouin 1991). There has been research on how to reduce the heat impact with nutritional manipulations. It is now well documented that the inclusion of fats in rations stimulate feed and energy consumption (Daghir, Nutrient requirements of laying hens under high high temperature 1987).

Daghir (1987) also provides alternative information on ingredients that can help to manage costs in developing countries. With corn being a principal ingredient in poultry feed and a major staple food in many African countries, put pressure on its price and therefore on the feed costs significantly.

The FEEDIPEDIA project (<http://www.feedipedia.org/>) hopefully addresses this feed challenge. It appears as an open access information system on animal feed resources, and provides information on nature, occurrence, chemical composition, nutritional value and safe use of nearly 1400 worldwide livestock feeds and ingredients (INRA n.d.). The main objective of FEEDIPEDIA is to provide extension with the latest scientific information. This database covers feedstuffs that can be found in tropical, subtropical and Mediterranean regions. From FEEDIPEDIA, Table 2.5 gives essential nutrient values of available feed ingredients in DRC, locally or imported. This project is managed jointly by French agronomic institutes ([INRA](#), [CIRAD](#), [AFZ](#)) and the [FAO](#).

Table 2.5 Nutrient value of some ingredients available in DR Congo

Main analysis	Dry matter	Crude protein	Crude fiber	Total sugars	Gross energy	ORIGIN
Unit	% as fed	% DM	% DM	% DM	MJ/kg DM	
Maize	86.3	9.4	2.5	2.1	18.7	IMPORTED/ LOCAL
Wheat Bran	87	17.3	10.4	7.1	18.9	LOCAL
Soybean Meal	87.9	51.8	6.7	9.4	19.7	IMPORTED
Peanuts	95.4	29.7	2.9	7.8	29.3	LOCAL
Peanuts Meal	89.3	54.8	11.7	9.8	20.4	LOCAL
Fish Meal	92.1	75.4			21.9	IMPORTED/ LOCAL
Palm Kernel Meal	91.2	16.7	19.8	2.4	20.1	LOCAL
Palm Oil	68.4	11	7.9		23.1	LOCAL
Cassava dried leaves	89.6	25.5	17.1	4.9	19.7	LOCAL
Cassava Peels	87.4	5.2	14		19.5	LOCAL
Soya beans toasted	88.6	39.5	6.5	8.8	23.8	LOCAL
Rice paddy	88	8.3	11.1		17.6	LOCAL
Rice Bran	90.2	12.7	16.3	2.8	20.2	LOCAL
Bambara Groundnut	96.6	18.2	14.2		19.2	LOCAL
Red Beans	87.9	26.1	4.1	0.4	19.2	LOCAL

Source: Feedipedia web database (www.feedipedia.org/)

2.6 Congolese eggs market and industry

Table egg consumption in DR Congo is still low compared to other countries. While the average annual consumption of eggs per capita is globally around 9 kg, it is only 4.3 kg in Africa, and less again in sub-Saharan Africa. There is a link between consumption level and wealth or per capita GNP, even if eggs can be considered as inferior goods in developed countries.

In developing countries, livestock product demand like table eggs is driven by economic growth, per capita incomes and urbanization. The FAO outlined that the relation between per capita income and meat consumption shows a strongly positive effect of increased

incomes on livestock consumption at lower income levels but a less positive, or even negative, effect at high levels of GDP per capita (FAO, The state of food and agriculture 2009).

This pattern is the same for eggs consumption in DR Congo. Nevertheless, although being among the poorest countries with the lowest per capita GDP of 450\$, DR Congo has a high potential and growing demand with its 67.5 million inhabitants, of which 40% live in town or cities. Kinshasa the capital alone has now more than 9 million inhabitants.

2.6.1 Existence of regional segments

This general figure hides the high discrepancies between various towns and villages, and between different income classes in the different communities, especially the large cities, such as Kinshasa, Lubumbashi and Katanga. Egg consumption in the large cities tends to be much higher than in the smaller towns and rural communities. It also tends to rise with income. People tend to eat eggs as omelets at breakfast or boil them to eat as part of a meal or as a snack. They may eat them at home or away from home in restaurants or road-side vendors. With the increasing income and the rapid urbanization in DR Congo, it is prudent to expect that demand for eggs is going to continue to rise.

The observed prices in selected relevant towns lend credence to the heterogeneity of the locations and also point to the inherent shortages in supply due to absence of local production and difficulty of meeting demand. Table 2.6 could give a false idea of possible arbitrage in a free market that could normally equalize these price differences in the country. In fact, the observed price level is already a result of feasible internal transactions, including costs. Eggs sold in Tshikapa for example come from Kinshasa by air or from Kananga by road. And Kananga itself and Mbuji-Mayi are supplied by eggs originating from Lubumbashi transported by train over 1000 km. High airfreight cost, bad national roads and irregular train schedules increase transportation costs significantly given the high perishability of eggs in a high temperature environment.

Table 2.6: Egg Prices in DRC Towns on December 2014 (30-eggs trays)

Town	Prices
Kinshasa	\$5.0 - \$6.5
Matadi	\$5.5 - \$6.0
Lubumbashi	\$5.3 - \$6.5
Mbuji-Mayi	\$6.0 - \$7.0
Kananga	\$6.3 - \$7.0
Tshikapa	\$7.0 - \$8.5
Moanda	\$6.0 - \$7.0
Goma	\$5.2 - \$6.2
Kisangani	\$5.6 - \$6.5

Source: Author’s surveys on October 2014

Figure 2.2 gives a global view of the “National 1” Road in 2006. Green parts mean good, while yellow and red refer respectively to fairly and impracticable parts of this main road. Some small improvement have been made in the past five year, mainly at the East of Kinshasa, toward Kikwit. The center region around Kananga (from Tshikapa to Mbuji-Mayi) remains quite isolated.

Figure 2.2: South of DR Congo Map (“National 1” Road in 2006)



Source: Wikipedia

2.6.2 Existence of social segments

As many other consumption goods, eggs have different prices even inside the town. Most of the eggs are sold in the popular market to low revenue families at lower prices. Quality of yolk, cleanness and size do not matter very much for these consumers. Price is the key factor, more for the middle man than the final buyer (in fact the retail price tend to be very

stable). The retail 30-eggs tray's price is now around \$5.90 in popular Kinshasa markets. Many retailers sell their eggs already boiled, at a little higher price.

Middle and high income families, including most of expatriates, buy their food in supermarkets, where the same egg tray is sold around \$7.50. Usually, superstores do repack eggs in smaller half-dozen packs, which are more convenient for transport. Uniformity and color appear the most attractive features.

Kinshasa and Brazzaville are the political and financial capitals of the Republic of Congo and DR Congo and are the two closest capital-cities in the world, separated only by the great Congo River. (There is not yet a bridge between them). A part of the local egg demand in Kinshasa is driven by Brazzaville's traders, where the poultry industry is also not developed. One of the three major farms has organized its marketing strategy to serve this market. It is the only neighbor country (among nine neighbors) where domestic eggs are exported.

2.6.3 Egg supply in DR Congo

The supply of local eggs in the DR Congo is concentrated in Kinshasa region. Very few poultry farms can be seen throughout the hinterland of this big country. In Kinshasa, the production comes mainly from the three major farms: BELIAR (Belgian), MINOCONGO (Lebanese) and MIDEMA (American) that produce together around 20,000 trays per day. They raise different breeds and have implemented modern cages systems. Each of these farms manufacture its own feed, and the two last (MIDEMA and MINOCONGO) make it in separate feed mill units that also sell to other farmers.

The other source of local eggs in the market come from medium and small farms. This production is not enough to cover all the expressed demand, so that imported eggs have become important. In the Southern and eastern part of the Congo, supplies come from neighbor African countries: Zambia, Uganda, Rwanda, and Zimbabwe mainly. As they are not significant local producers, these imported eggs do not face real competition.

In the western part (Kinshasa region), eggs are imported in frigorific containers discharged in the Matadi Port, and come now not only from Europe, but also Brazil and India. These frozen eggs have a very short lifetime, and spoil in a few days once unloaded from their containers. They are sold at low prices, creating momentary surplus in the popular market and pulling prices down. Despite that consumers are generally reluctant to purchase these eggs, but with poor families being more price sensitive, they are quickly sold.

CHAPTER III: DATA, ASSUMPTIONS AND MODELS

The primary purpose of this research was to evaluate the economic feasibility of table egg production in DR Congo. Based on the country's current economic situation, the study sought to develop a strategy to market the produced eggs using a carefully differentiated market strategy. This chapter presents the sources of data used in the study and the assumptions that underscore the economic feasibility analyses. It also described the economic model that are used to conduct the analyses.

3.1 Production Data and Assumptions

We will use Z-CO's data for the period 2007-2014, and evaluate the farm's productivity and performance indicators (laying rate, hens' ages and number, feed conversion, laying period length, etc.). As the analysis will need assumptions about production, we will put them on a realistic base (number of birds per year, number of years of the analysis, growth in productivity, growth in cost, etc.). However a brief overview of the Z-CO farm context is necessary.

3.1.1 Z-CO Farm presentation

Z-CO layers' farm is a family owned business operating since 2005 in DR Congo. The layers' farm is located near the village of Kasangulu, 30 km south of Kinshasa, the country's capital. The farm is erected on beautiful well-ventilated hills and is close to the main road connecting to Kinshasa, called the National-1 Road.

A part of hens is placed in refurbished cages' house, while others are kept on floor in different houses, on a deep liter made of wood shavings, where they are supplied with drinkers and feeders. The farm have then following birds' houses:

- One 50m x 13m house equipped with cages
- Two 40m x 15m houses for layers on litter, divided in several compartments
- Two 60m x 12m houses for rearing birds and layers on liter
- Four circular houses (200 square meters each) used for rearing day-one chicks.

The farm has the capacity to host 30,000 hens (12,000 hens in cages, and 18,000 in litter houses), which was reached four years ago. The number of hens declined since and farm has now around 12,000 hens only.

The day-one chicks are imported from France, and spend an entire day on air to reach Kinshasa. They are no hatchery nor serious local supplier of day-one chicks. The management of chick stress upon their arrival is critical. A high rate of mortality is generally observed within the first week, although chicks are delivered generally with an excess of 4% to cover such casualties. The hens are all the ISA Brown race, laying brown colored eggs. This hybrid come for crossing of Rhode Island White and Brown breeds, and is known to be prolific in eggs production. These also more heat tolerant.

Feed supply is still being a big challenge for all the Congolese livestock farming sector. At the beginning, seven years ago, Z-CO bought its feed from MIDEMA, who held a longstanding monopolistic position in the feed industry. MIDEMA failed many times to maintain feed quality, and increased continuously its monopolistic prices, being sole feed provider in the market.

After years, Z-CO farm started making its own feed, at a quite competitive cost. It worked very well in the beginning, but progressively faced many logistic challenges as shortage of ingredients, excessive transit delay for imported premixes and soybean meal. These impacted the general performance of the farm, caught in trade-off between feed cost reduction and feed quality and availability. This focus on only feed cost, without enough emphasis on layer production and overall business performance, had a negative impact on the farm growth.

3.1.2 Z-CO Farm production data

We use data collected from Z-CO for the past seven years. Annual production data from Z-CO farm are summarized in Table 3.1.

Production increased from the beginning in 2007 with 280 egg trays per day and reached its peak in 2010, when 727 trays were produced daily. However it declined since,

falling even in 2013 to its lowest level (189 trays daily), even though 2014 showed positive signs of recovery. The production path followed the number of laying hens during the same period.

The data outline that the ratio of laying hens in total birds seems to vary a lot. This could explain the inability to maintain a regular level of eggs' production. The ratio between raising birds and laying hens is very important, as it allows smooth hens' renewal with less budget constraints, as raising cost occupies a significant amount in a laying farm expenses. This element will be addressed in the production assumption in following section.

Figure 3.1 shows some key performance parameters for Z-CO farm over the seven years. The laying rate appeared low (67%) compared to the breeders' manual guideline (84%). This rate declined much since 2011, even if it lightly raised recently. The period of low laying rate faced also higher mortality rate, low egg weight and higher feed intake. It is obviously related to feed efficiency and overall farm management practice. The farm could increase significantly its production to its capacity by addressing some key factors.

The production norms according to the guidelines and observed at Z-CO laying rate for a layers' generation are given in Table 3.2. The Objective column shows what can be set as achievable goal if good production practices are implemented. The Z-CO laying pattern records much lower rate throughout the laying period. Laying begins later, and the peak is lower and drops off more quickly than what has been projected in poultry manuals. The reasons for these are numerous but some are the factors discussed above in the literature – the heat, feed and other husbandry challenges the confront production in a country such as DR Congo.

Figure 3.1 Evolution of Z-CO farm performance indicators (2007 – 2014)

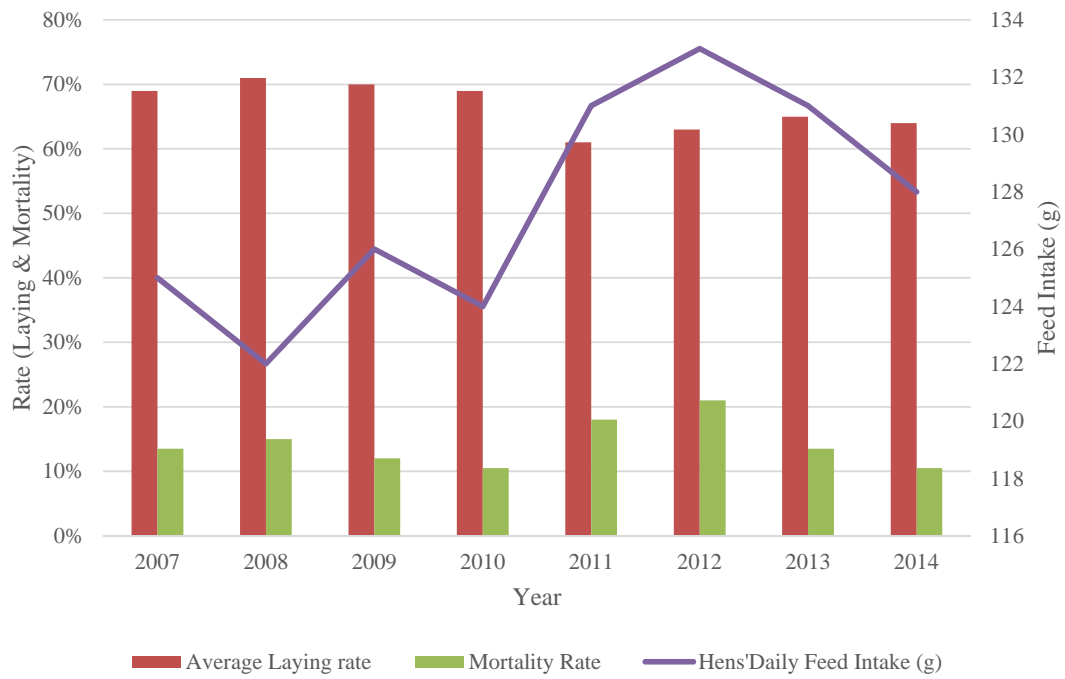


Table 3.1 Production and efficiency data of Z-CO from 2007 to 2014

Year	Birds Total	Rearing Birds	Laying Hens	Production (30 eggs' trays)	Daily Eggs' Production	Layers' Feed (MT)	Rearing Feed (MT)
2007	28,100	15,900	12,200	101,016	281	550	145
2008	38,300	19,600	18,700	159,324	443	820	160
2009	33,700	12,300	21,400	179,760	499	970	150
2010	31,600	-	31,600	261,648	727	1,405	45
2011	28,400	6,500	21,900	160,308	445	1,030	65
2012	24,200	11,500	12,700	96,012	267	610	125
2013	23,000	14,300	8,700	67,860	189	410	120
2014	18,200	5,600	12,600	96,768	269	580	40

Source: Z-CO Farm

Table 3.2 Layer rate in guidelines manual (norm) and for Z-CO farm's hens (actual)

Month	Norm	Actual	Objective	Realistic
1	0.0%	0.0%	0.0%	0%
2	0.0%	0.0%	0.0%	0%
3	0.0%	0.0%	0.0%	0%
4	0.0%	0.0%	0.0%	0%
5	22.0%	3.8%	20%	14%
6	91.1%	60.0%	84%	80%
7	95.0%	82.3%	88%	83%
8	95.0%	80.6%	89%	85%
9	94.8%	79.3%	89%	85%
10	94.3%	78.8%	89%	84%
11	92.8%	77.9%	87%	84%
12	90.6%	75.9%	85%	82%
13	88.4%	73.8%	83%	81%
14	86.2%	71.5%	81%	81%
15	84.0%	68.7%	79%	77%
16	81.8%	63.4%	75%	72%
17	79.6%	60.5%	73%	73%
18	77.4%	55.4%	71%	71%
19	75.2%	52.6%	69%	69%

Cages or deep litter housing system

Using data from Z-CO operations between October and December 2013, we obtained following summary for hens housed in cages and on deep litter (Table 3.3).

Table 3.3 Summary statistics on laying rate for cages and litter hens

VARIABLES	N	Mean	St. Dev.	Minimum	Maximum	Age (months)
Cage Laying Rate	237	61%	0.26	38%	91%	16
Litter Laying rate	18	68%	9%	51%	81%	12

Source: Author, from Z-CO data on December 2013

Even if difference in hens' age don't allow conclusive comparisons, hens raised on deep litter seem to have at least similar performance than those in cages. Variability in laying rate is greater in cages than on floor. Maximum laying is obtained in cages, as well as the least one. Laying on litter appears more stable, even if the average is lower.

Even in literature, there seem to be inconclusive evidence that cages have better performance than litter system. However in DR Congo, given the high cost of cages, deep litter houses with good equipment will remain the choice of small scale farms.

The Table 3.4 compare capital cost needed for cages and deep litter systems. Housing can cost slightly less for cages, while cages equipment is much more expensive than material needed on floor system. The need for electricity is also important for running cages, even if manual cages are also an option. However, cages save labor cost and give cleaner eggs than litter one.

Table 3.4 Comparative costs for cages and deep litter system

Housing System	Birds quantity	Houses Number	Houses Cost	Equipment Cost	Total
Cages	40,000	3 (50m x 12)	\$150,000	\$390,000	\$540,000
Deep Litter	40,000	8 (40m x 15)	\$160,000	\$80,000	\$240,000

The lifetime (amortization) is 15 years for houses and 5 years for equipment. In a five-year analysis, these elements will be important in evaluating investment profitability, by taking in account the salvation value.

3.1.3 Production data assumptions

One major assumption about production data comes from time sequence of laying. Laying begins approximatively at the 20th week or fifth month, and can last until the 20th month. For simplicity, we will consider the six first months (two quarters) as the rearing period (no laying) and 12 months of laying.

A calendar year will then not cover the entire hens' lifetime, so that costs and revenues will overlap on the basic year. This is very important in the revenue statement, avoiding the mistake of placing rearing cost and all lays in one calendar year, as did Mwansa when he estimated budget for producing 60,000 eggs trays within a year (2013, 36).

It is then important to carefully manage successive generations in the farm so that output and premium eggs are at a high level. Figure 3.3 gives a progressive scheme for implementing and managing a multi-levels hens' generations.

In three-generation' case, the second cohort of day-old chicks arrive at the twelve month of the first generation, so that the beginning of laying in this second group will coincide with the decline in laying in the first group. From one in the first year, the second year will keep two cohorts and finally after the third years, three generations will be permanently on the farm. In the third year monthly production will be double. This obviously suppose adequate housing and equipment to allow the "All-in All-out" sanitary principle.

We will use a two-generation' situation in our analysis, which is also simpler to manage for small farms. The new cohort is then brought twelve months after the previous, so that new layers replace culled hens.

The production is assumed to be split in two locations, including the actual farm, beginning with 27,000 hens in total, split in two locations, Kinshasa (the current farm) and Kananga (covering the Kasai region). Laying houses building will occur only in Kananga using available local material.

The period of analysis will be five years, and the production could raise over this period on all locations, but more sharply in Kananga then in Kinshasa. The total number of laying hens will evolve consequently, following the assumption expressed in Figure 3.3.

As it appears in Table 3.5, laying rates used in the current analysis are higher than the actual ones, but less than the objective rates (Target). We assume that accurate production strategy will be implemented to become a little closer than the recommended guidelines norms.

Table 3.5 Assumption on laying rates, compared to norms, actual and target rates

Quarter	Norm	Actual	Assumption	Target
1	0.0%	0.0%	0.0%	0%
2	37.7%	11.0%	25%	15%
3	94.9%	79.0%	88%	82%
4	92.6%	77.5%	85%	81%
5	86.2%	71.3%	81%	78%
6	79.6%	59.8%	75%	71%
Laying Period Average	88%	72%	82%	78.0%

Source: Author's calculations

3.1.4 Feed sourcing and costs

Feed can be locally sourced or manufactured on the farm. Two main feed makers operate in Kinshasa, MINOCONGO and MIDEMA, which also possess the two biggest farm of the Kinshasa region. They don't compete on feed price charged to their external competitors. The layers' standard feed cost is \$790.00 per metric ton. Chick feed is priced a little higher, so that we consider an average price of \$800.00 for both rearing and laying periods.

Daily feed quantity per hen is 0.12 kg, while for chicks and rearing birds it increases weekly from 0.05 kg the first day and reach the 0.12 kg intake level at the end of fifth month.

Making feed on the farm is one key strategic component, and it is even the only economical solution for the Kananga location, where ingredients are much cheaper than in Kinshasa. We can consider that making own feed could reduce feed cost by 10% in Kinshasa and 20% in the Kananga region.

There are various agricultural and animal relatively cheaper products and byproducts that can be used efficiently when it comes to processing poultry feed. This requires careful consideration of their relative nutrients content and the presence of anti-nutritional factors (Table 2.5).

The cost of key products in Kananga (center of the country) market compared to Kinshasa is given in Table 3.6.

Table 3.6 Key agricultural ingredients' prices in Kinshasa and Kananga regions (per kg)

Product	Nutrients	Kinshasa	Kananga
Maize	Energy, protein	\$0.6	\$0.25
Soybean	Protein, energy	\$1.5	\$0.6
Palm Kernel	Fiber, protein	\$0.2	\$0.05
Cassava Roots	Energy	\$0.5	\$0.2
Peanuts	Protein, energy	\$0.9	\$0.6
Wheat Bran	Fiber	\$0.2	-
Rice Hulls	Fiber	\$0.25	\$0.1

Source: Author's survey in February 2015 (low season)

It is therefore possible for the small scale farm to build up their local feed formula with some optimization techniques and guidance of a nutritionist, to have cheaper feed but of high quality. Premix in all cases of local feed production can still be imported to guarantee sufficient nutritional values.

As the unit cost of feed could varies in our analysis, as well as the egg price, we won't use the common assumption of fixed feed cost percentage of revenue. This percentage could therefore vary and become a performance indicator for small layers' farms.

3.1.5 Other Costs assumptions

Other costs have been derived from Z-CO farm accounting sheets, and adjusted to an average for each line. In this section, we explain each cost and how they may evolve over the next years.

- a. **Building and equipment costs:** This cost refers to poultry housing, water and electricity supplying as well as the cost of acquiring feeders and drinkers. In the case of a small layers' farm, hens' houses are simple, open air ventilated, meaning low cost on wall mounting. Attention will be paid on an isolating roof, to reduce heat impact on hens' performance. Feeders and drinkers are manual and locally made.

The houses and material are initially set to support an increase in hen numbers without any additional investment during the 5-years period.

The building and equipment costs are as given in Table 3.4. As their lifetime is 10 years, we'll use only half of that cost in the analysis.

- b. Chick cost: The cost of importing day-old chicks is \$1.80/bird delivered in Kinshasa and will remain unchanged over the period of analysis. We are not going to source day-old chicks locally.
- c. Mortality rate: The mortality rate is important to consider, as it is higher at the beginning for stressed chicks. It is assumed to be around 8% the first month, and decrease immediately during the following months. The total mortality for the lifetime of hens will set to be 16%, assuming implementation of good feeding and sanitary policies in the farm.
- d. The rearing cost, including chick and pullet feeding and vaccination, is estimated around \$10.00 per pullet, from day one to the sixth month. The cost of importing chicks is included.
- e. Other variable costs: We include water supply, oil, electricity, vaccination and medication, litter changing and salaries. While important for hens and overall farm performance, these costs are relatively small in the overall cost. They are assumed to be around \$2.00 monthly per hen or 6% of feed cost in our analysis.
- f. Special costs: Some strategies will call on new cost or increase in some of them, like packaging, when special and more convenient packs must be used. That is also the case for marketing cost that must accompany a market segmentation and targeting strategy. We postulate that these cost could represent \$0.25 per tray, or 4% of sale when implemented.

g. Taxes: agricultural activities are not heavily taxed in DR Congo. Companies involved in this sector pay some fixed amount on their revenue depending on their size. Other small taxes apply, for land usage, agricultural services and local authorities.

We assume all these taxes to be around 20% of earnings before interest and tax (EBIT).

Figure 3.2: Multi-generation layers scheme assumption for Z-CO Farm

YEAR	G1	G2	G3	G4		G1	G2	G3	G4	G5	G6	G7
0	G1					G1						
0	G1					G1						
0	G1					G1						
0	G1					G1						
0	G1					G1						
0	G1					G1						
1	G1					G1	G2					
1	G1					G1	G2					
1	G1					G1	G2					
1	G1					G1	G2					
1	G1					G1	G2					
1	G1	G2				G1	G2	G3				
1	G1	G2				G1	G2	G3				
1	G1	G2				G1	G2	G3				
1	G1	G2				G1	G2	G3				
1	G1	G2				G1	G2	G3				
1	G1	G2				G1	G2	G3				
2		G2					G2	G3	G4			
2		G2					G2	G3	G4			
2		G2					G2	G3	G4			
2		G2					G2	G3	G4			
2		G2					G2	G3	G4			
2		G2	G3					G3	G4	G5		
2		G2	G3					G3	G4	G5		
2		G2	G3					G3	G4	G5		
2		G2	G3					G3	G4	G5		
2		G2	G3					G3	G4	G5		
2		G2	G3					G3	G4	G5		
3			G3						G4	G5	G6	
3			G3						G4	G5	G6	
3			G3						G4	G5	G6	
3			G3						G4	G5	G6	
3			G3						G4	G5	G6	
3			G3	G4						G5	G6	G7
3			G3	G4						G5	G6	G7
3			G3	G4						G5	G6	G7
3			G3	G4						G5	G6	G7
3			G3	G4						G5	G6	G7
3			G3	G4						G5	G6	G7

Note: G1, G2 ... mean 1st generation, 2nd generation, etc. When red, rearing, not laying. At left the two-generation scheme, and at right the two-cohort system.

3.2 Demand Structure and Assumptions

3.2.1 The urban market size assumptions

DR Congo represent a huge market with its population of 67.5 million. However, the egg market is essentially located in town. Urban population is the marketable demand for table egg production.

The urban population in the country have grown faster than the rural over past decade (Table 3.7).

Table 3.7 Evolution of global and urban population in DR Congo from 2003 to 2014

Year	Total Population (000)	Urban population (000)	% Urban Population	Population Growth	Urbanization Growth
2003	50,972	15,457	30.3%		
2004	52,487	16,127	30.7%	3.0%	4.3%
2005	54,028	16,835	31.2%	2.9%	4.4%
2006	55,591	17,580	31.6%	2.9%	4.4%
2007	57,188	18,370	32.1%	2.9%	4.5%
2008	58,819	19,206	32.7%	2.9%	4.6%
2009	60,486	20,074	33.2%	2.8%	4.5%
2010	62,191	20,975	33.7%	2.8%	4.5%
2011	63,932	21,910	34.3%	2.8%	4.5%
2012	65,705	22,878	34.8%	2.8%	4.4%
2013	67,514	23,880	35.4%	2.8%	4.4%

Source: FAO STAT, author's calculations

In this study, we will focus on two locations, encompassing their neighbor towns: Kinshasa and Kananga (Table 3.8).

Table 3.8 Population in targeted towns' areas

LOCATION	SURROUNDING TOWNS	POPULATION	ASSUMPTIONS	%
Kinshasa	Kinshasa	9,100,000		
	Total	9,100,000	9,000,000	72.0%
Kananga	Kananga	1,000,000		
	Tshikapa	860,000		
	Mbuji-Mayi	1,850,000		
	Total	3,710,000	3,500,000	28.0%
TOTAL		12,810,000	12,500,000	100%

Source: Government data (National Statistics Institute)

The population of these places is expected to grow by an average of 4.5% per year for the next five years, consistent with the past decade. In the Kinshasa region, where average revenue is much higher, only a small part of the population is targeted for special egg demand, as explained in following section, and this smaller part could even grow a little faster. In the Kananga region by contrast, a greater part of the population will be targeted, given the prevalent high prices and absence of local fresh egg production.

3.2.2 Segmentation and demand's growth assumptions

To survive in a competitive environment, Z-CO has to follow a segmentation strategy, targeting high and middle upper income consumers to whom it can offer high value eggs. The African Development Bank (AfDB, 2011) stated that the economic growth in Africa over the past two decades has been accompanied by the emergence of sizeable middle income class (AFDB 2011). By middle class, AfDB meant people with daily consumption between \$2 and \$20. They divided this group into three sub-categories:

- The floating middle class: They have daily consumption expenditure between \$2 and \$4. They are just above the poverty line and are susceptible to sliding back into poverty with any adverse shock to the economy.
- The lower-middle class: With daily consumption of between \$4 and \$10, they are comfortable enough to be above the subsistence level and are able to consume non-essential goods.
- The upper-middle class: People in this group have daily consumption of between \$10 and \$20.

The AfDB also identifies the rich, those with daily per capita consumption expenditures in excess of \$20. Z-CO target market for premium eggs offering will be consumers in the rich and upper-middle classes. Eggs that do not meet the stringent quality specifications demanded by the Z-CO Premium category will be sold in the commodity market at prevailing prices and not into the premium market.

We assume that Z-CO Farm can split and re-localize its assets into the two major cities, i.e., Kinshasa and Kananga, where there is currently very low competition in the fresh table egg market. The Kananga market also has the advantage of having some basic feed ingredients that are much cheaper than in Kinshasa. Table 3.9 summarizes the market size assumptions, drawing on World Bank population data and AfDB estimates of the different income classes.

It is assumed that the rich and middle class together will account for 39.2% of the population in the two cities and that the relevant potential customers in this is only 9.54%. Of this, Z-CO will secure 1% in Kinshasa and 2% in Kananga. This would give a total potential market of about 13,595 people. We assume that these people eat one egg per day throughout the year. This implies that Z-CO would sell more than 5.5 million premium eggs or 183,116 premium 30-egg trays per annum.

This demand profile defines the production requirements that are planned by Z-CO. The growth in production is assumed to emanate from growth in the population, the GDP and the size of the middle and rich class alone (a 10% annual growth in production). This, we believe, is a conservative assumption since growth would occur in market share increase in addition to the increase in population and target consumer class size.

Table 3.9 Assumptions Driving Production Model

	KINSHASA	KANANGA	TOTAL
Population	9,000,000	3,500,000	12,500,000
Rich & Middle Classes	39.2%	39.2%	39.2%
Rich Class	4.8%	4.8%	4.8%
Middle Class Percent	12.40%	12.40%	13.44%
Upper Middle Class	4.70%	4.70%	4.70%
Rich and Upper Middle Classes	9.54%	9.54%	9.54%
Potential Premium Customers	858,600	333,900	1,192,500
Targeted Premium Customers' Market Share	1.00%	1.50%	1.1%
Premium Consumers' Basket	8,586	5,009	13,595
Premium Eggs Consumption quantity in a Day	1	1	
Days of Consumption per Year	360	360	
Annual Premium Egg Consumption	3,090,960	2,404,080	5,495,040
Share of Premium Egg in Total Produced Eggs	70%	70%	
Annual Total Egg Production	4,415,657	3,434,400	7,850,057
Targeted Average Laying Rate	78%	78%	
Hens' Required Number	15,725	12,231	27,956
Day-old Chicks Needed in Preceding Year	18,500.32	14,389.14	32,889.46
Annual 30-Eggs Trays Production	147,189	114,480	261,669
Premium Eggs Trays Production	103,032	80,136	183,168
Ordinary Trays' Production	44,157	34,344	78,501

Source: AFDB and World Bank

3.3 Economic Models and Assumptions

The purpose of this research is to evaluate the feasibility and profitability of a small layers farm in a competitive environment. We assume a 5 years period of analysis. It is necessary to check if the laying farm project is an acceptable investment compared to other alternative projects. It is important to ensure not only that future cash flows cover expected future costs and obligations, but also that the risk taken by investing worth it.

Financial analysts traditionally use one or more of following approaches to evaluate investment over time: (i) Discounted Payback Period; (ii) Net Present Value; and (iii) Internal Rate of Return. We have chosen the method of analyses as the last two.

3.3.1 The Net Present Value

The Net Present Value model evaluates the value of an investment today by discounting all future net cash flows over the lifetime of the investment, by using an opportunity cost of capital as the discount factor. It gives different values to a nominal cash flow, depending to the period it takes, and avoids a common mistake of adding numbers as they appear regardless of time.

The choice of the discount rate is an important assumption. Usually the prevailing interest rates of securities or Treasury bonds are taken, but this choice must refer to the alternative return offered in the market for similar risk investment. Treasury bonds being zero risk investment cannot be taken in evaluating riskier projects.

In practice, it is common to take the cost of borrowing money from the market or a bank to finance similar investments. This will be the case in our study. The interest on the Central Bank Bonds in DR Congo is around 2%, Long Term Deposits in commercial banks are paid 4 to 5%, while these banks' loans are priced at 16%. We will use an opportunity cost of 20%, as agriculture and farm projects are considered riskier business by most of local banks that prefer to lend to commodities traders.

For the NPV method, only cash flows are relevant, and inflation must be treated. Deflation approaches must be applied on cash flows as well as on the discount rate used. When the discount rate used contains the amount of expected inflation, it may be used as it is without deflating successive cash flows.

In our case, prices and values are expressed in constant dollars, isolated from local currency inflation, so that it does not appeal to further adjustments.

The NPV formula can be expressed as follow:

$$NPV = -C_0 + \sum_{i=1}^T C_i / (1+r)^i$$

- C_0 : initial investment

C_i : cash flow at time i

r : discount rate

The decision criterion with the NPV method is to accept investments showing positive Net Present Value, what occurs when the discounted future cash flow exceed actual investment cost.

3.3.2 The Internal Rate of Return (IRR)

This method compare the relative return of an investment to its cost. The IRR is the calculated discount rate which 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 n.d.) The IRR and NPV analyses give close results; when the opportunity cost of capital is less than the IRR, this investment will have necessarily a positive NPV using the same opportunity cost of capital.

The opportunity cost of capital that will be used to compare IRR in our estimations is still 20% as described above in NPV section.

3.3.3 Sensitivity analysis

As long as the results for NPV and IRR methods depend on relevant assumptions made about levels and factors influencing production, demand and revenue, it is important to visualize other possible results if such conditions or assumptions vary. Sensitivity and scenario analysis help to determine the viability of an investment, by applying probabilities on the different possible outcomes. When an investment shows positive NPV or IRR in a pessimistic scenario, even at lesser magnitude, it is good to know it. The common pitfall of many small businesses is to be too optimistic and neglect to see all the facets of the big picture, drawing conclusions on positive assumptions only. A comprehensive likelihood must be assigned to each scenario, even if it is based on another assumption.

CHAPTER IV: RESULTS AND DISCUSSION

As the framework of the current study is now set up, this chapter describes tools or methods used to meet our target. The purpose of designing a comprehensive and global strategy for a small scale farm like Z-CO implies a thorough analysis of existing production and marketing parameters. The completion of this multidimensional task requires two different set of methods, depending to the subpart of the topic.

4.1 Production Performance over Next Decade

4.1.1 Production forecast

The initial number of hens is expected to grow to the farms' capacity by the fifth year, and maintain this level of operations after that. As a result, Table 4.1 shows the trend for the first five years, showing an annual increase of 10% during this period. The table shows that we will start with the number of hens necessary to meet the targeted production and market share (27,956) that will increase to the manageable capacity of 40,000 layers in the fifth year. At that point, we would reach capacity of the layer houses and can increase size only if we make further investment in housing.

Table 4.1 Expected evolution of production in the first five years

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Hens' Number	27,956	30,752	33,827	37,209	40,930	45,023
Day-old Chicks Needed	32,889	36,178	39,796	43,776	48,153	52,969
Average Laying Rate	78%	78%	78%	78%	78%	78%
Total Egg Production	7,850,057	8,635,063	9,498,569	10,448,426	11,493,269	12,642,596
30-Egg Tray Production	261,669	287,835	316,619	348,281	383,109	421,420
Premium Egg Tray Production	183,168	201,485	221,633	243,797	268,176	294,994
Ordinary Tray Production	78,501	86,351	94,986	104,484	114,933	126,426

4.1.2 Demand forecast

The demand of eggs in general is expected to follow the population growth, and could even increase more as the country is facing continuous high economic growth rate in recent years. The annual growth of GDP is expected to grow above 7% for the next five years, according to the World Bank forecasts (World Bank 2015), with a population growth of 3% annually. The base of upper middle class will also increase with country's revenue, and the share of targeted consumers has the potential to double within the same period. The production numbers figured in Table 4.1 can then be absorbed quite easily.

4.2 Economic Performance over Next Years

4.2.1 Eggs prices evolution on different segments

Eggs' prices are in different segments, for premium eggs and ordinary ones. Details on product differentiation is given later in Chapter 5. Table 4.2 outlines the pricing for the different product categories. These prices are assumed to remain stable over the first five years of the project.

Table 4.2 Price differentiation in Kinshasa and Kananga markets

	KINSHASA	KANANGA
PREMIUM EGG TRAY	\$ 6.50	\$ 7.00
ORDINARY EGG TRAY	\$ 5.00	\$ 6.00

4.2.2 Projection of costs

Chicks and rearing cost will remain stable during the analytical period, as no local sourcing of one-day chicks is scheduled. The inclusion of the marketing and labelling costs will depend on the strategic move chosen. Feed cost will depend on sourcing strategy. In-farm made feed will cost less than outsourced feed. The gain of making its own feed will be much less in Kinshasa than in Kananga given the difference in cost of ingredients.

4.2.3 Income statement

From all data above, income statements have been generated for a standard generation of hens covering 18 months of their lifetime. These statements will differ depending on the location and strategic assumption regarding price differentiation and feed sourcing. Three different scenarios are analyzed in two locations (Kinshasa and Kananga):

- Current market situation of ordinary eggs' and feed prices
- Blue ocean market with valued eggs (premium price) and/or
- Innovation in feed sourcing and cost.

Table 4.3 and 4.4 give income statements with prevailing feed cost and egg prices, respectively in Kinshasa and Kananga's markets. The margin appears very tight in Kinshasa, expressing obviously that small layers' farms in this context are not viable in this environment. The situation however is potentially much better in Kananga due to higher egg price. All this will be clearer when we calculate the NPV and IRR in coming sections.

From the basic income statements, we derive alternative statements from both location with different scenario regarding feed sourcing and market segmentation. These income statements appear in Table 4.6 and 4.7 for Kinshasa and Kananga locations respectively. These tables outlines that the impact on farm profitability is greater when applying segmentation in Kinshasa than in Kananga. Inversely, reduction of feed cost increases profit much more in the Kananga region.

Table 4.3 Actual income statement for a generation of hens in Kinshasa market

	Rate	Base	Amount
COSTS			
Chicks number		18,500	
Chicken Cost	1.6		\$ 29,600.00
Mortality	15%		
Live Birds		15,725	
Rearing cost (Pullets feeding)	\$ 10.00		\$ 157,250.00
Total rearing costs			\$ 186,850.00
Layers' feed quantity(12 months) Kg	0.12	679,320	
Layers' feed cost	\$ 0.80		\$ 543,456.00
Other costs	\$ 2.00	15,725	\$ 31,450.00
Marketing and labelling cost			\$ -
Total operating costs			\$ 574,906.00
TOTAL			\$ 761,756.00
REVENUES			
Hens number		15,725	
Laying rate		78%	
Daily Egg Production		12,266	
Daily Egg Trays Production		409	
Annual Trays Production (360 days)	360	147,186	
Ordinary Egg Tray Price		\$ 5.00	
Total Egg Sale			\$ 735,930.00
Culled hen price		\$ 2.50	
Culled hens sale			\$ 39,312.50
TOTAL REVENUES			\$ 775,242.50
EBIT			\$ 13,486.50
TAXES	20%		\$ 2,697.30
NET INCOME			\$ 10,789.20
NET INCOME %			1.39%
NET INCOME/LAYER			\$ 0.69

Table 4.4 Estimated income statement for a generation of hens in Kananga with actual costs and prices

	Rate	Base	Amount
COSTS			
Chicks number		14,390	
Chicken Cost CIF	1.6		\$ 23,024.00
Mortality	15%		
Live Birds		12,232	
Rearing cost (Pullets feeding)	\$10.00		\$ 122,315.00
Total			
Layers' feed quantity(12 months) Kg	0.12	528,401	
Layers' feed cost	\$ 0.84		\$ 443,856.67
Other costs	\$ 2.00	12,232	\$ 24,463.00
Marketing and labelling cost			\$ -
	TOTAL		\$ 613,658.67
REVENUES			
Hens number		12,232	
Laying rate		78%	
Daily Egg Production		9,541	
Daily Egg Trays Production		318	
Annual Trays Production (360 days)	360	114,487	
Ordinary Egg Tray Price		\$ 6.00	
Total Egg Sale			\$ 686,921.04
Culled hen price		\$ 2.00	
Culled hens sale			\$ 24,463.00
	TOTAL REVENUES		\$ 711,384.04
EBIT			\$ 97,725.37
TAXES	20%		\$ 19,545.07
NET INCOME			\$ 78,180.29
NET INCOME %			11.0%
NET INCOME / LAYER			\$ 6.39

Feed price in Kananga is higher than in Kinshasa, because it is assumed that the feed has to be imported from Zambia and transported by rail. Unfortunately, the rail system, as indicated in the introductory chapter, is very unreliable. This, then, will have the effect of increasing feed cost and consequently, total production costs.

Table 4.5 Income Statements for different scenario in Kinshasa

	WITH FEED INNOVATION			WITH SEGMENTATION			FEED INNOVATION AND SEGMENTATION		
	Rate	Base	AMOUNT	Rate	Base	AMOUNT	Rate	Base	AMOUNT
COSTS									
Chicks number		18,500			18,500			18,500	
Chicken Cost CIF	1.6		\$ 29,600.00	1.6		\$ 29,600.00	1.6		\$ 29,600.00
Death rate	15%			15%			15%		
Live Birds		15,725			15,725			15,725	
Rearing cost (Pullets feeding)	\$10.00		\$157,250.00	\$ 10.00		\$ 157,250.00	\$ 10.00		\$ 157,250.00
Layer feed quantity(12 months) Kg	0.12	679,320		0.12	679,320		0.12	679,320	
Layer feed cost	\$ 0.72		\$489,110.40	\$ 0.80		\$ 543,456.00	\$ 0.72		\$ 489,110.40
Other costs	\$ 2.00	15,725	\$ 31,450.00	\$ 2.00	15,725	\$ 31,450.00	\$ 2.00	15,725	\$ 31,450.00
Marketing and labelling cost			\$ -	4%	\$ 526,189.95	\$ 21,047.60	4%	\$526,189.95	\$ 21,047.60
									\$
TOTAL COSTS			\$707,410.40			\$ 782,803.60			728,458.00
REVENUES									
Hens number		15,725			15,725			15,725	
Laying rate		78%			78%			78%	
Daily Egg Production		12,266			12,266			12,266	
Daily Egg Trays Production		409			409			409	
Annual Trays Production (360 days)	360	147,186		360	147,186		360	147,186	
Ordinary Egg Tray Price		\$ 5.00			\$ 5.00			\$ 5.00	
Premium Egg Tray Price					\$ 6.50			\$ 6.50	
Ordinary Egg Tray Sale (30%)					66,234			66,234	
Premium Egg Tray Sale (70%)					80,952			80,952	
Total Egg Sale					\$ 331,168.50			\$ 331,168.50	
Culled hen price					\$ 526,189.95			\$ 526,189.95	
Culled hens sale			\$735,930.00			\$ 857,358.45			\$ 857,358.45
TOTAL REVENUES			\$775,242.50			\$ 896,670.95			\$ 896,670.95
INCOME (EBIT)			\$ 67,832.10			\$ 113,867.35			\$ 168,212.95
INCOME (EBIT) %			8.7%			12.7%			18.8%

Table 4.6 Income Statements for different scenario in Kananga

	WITH FEED INNOVATION			WITH SEGMENTATION			FEED INNOVATION AND SEGMENTATION		
	Rate	Base	AMOUNT	Rate	Base	AMOUNT	Rate	Base	AMOUNT
COSTS									
Chicks number		14,390			14,390			14,390	
Chicken Cost CIF	1.6		\$ 23,024.00	1.6		\$ 23,024.00	1.6		\$ 23,024.00
Death rate	15%			15%			15%		
Live Birds		12,232			12,232			12,232	
Rearing cost (Pullets feeding)	\$ 10.00		\$ 122,315.00	\$ 10.00		\$ 122,315.00	\$ 10.00		\$ 122,315.00
Layer feed quantity(12 months) Kg	0.12	528,401		0.12	528,401		0.12	528,401	
Layer feed cost	\$ 0.60		\$ 317,040.48	\$ 0.84		\$ 443,856.67	\$ 0.60		\$ 317,040.48
Other costs	\$ 2.00	12,232	\$ 24,463.00	\$ 2.00	12,232	\$ 24,463.00	\$ 2.00	12,232	\$ 24,463.00
Marketing and labelling cost			\$ -	4%	\$ 749,888.80	\$ 29,995.55	4%	\$749,888.80	\$ 29,995.55
TOTAL COSTS			\$ 486,842.48			\$ 643,654.22			\$ 516,838.03
REVENUES									
Hens number		12,232			12,232			12,232	
Laying rate		78%			78%			78%	
Daily Egg Production		9,541			9,541			9,541	
Daily Egg Trays Production		318			318			318	
Annual Trays Production (360 days)	360	114,487		360	114,487		360	114,487	
Ordinary Egg Tray Price		\$ 6.00			\$ 6.00			\$ 6.00	
Premium Egg Tray Price					\$ 7.00			\$ 7.00	
Ordinary Egg Tray Sale (30%)						\$ 309,114.47			\$ 309,114.47
Premium Egg Tray Sale (70%)						\$ 440,774.33			\$ 440,774.33
Total Egg Sale			\$ 686,921.04			\$ 749,888.80			\$ 749,888.80
Culled hen price		\$ 2.00			\$ 2.00			\$ 2.00	
Culled hens sale			\$ 24,463.00			\$ 24,463.00			\$ 24,463.00
TOTAL REVENUES			\$ 711,384.04			\$ 774,351.80			\$ 774,351.80
INCOME (EBIT)			\$ 224,541.56			\$ 130,697.58			\$ 257,513.77
INCOME (EBIT) %			31.6%			16.9%			33.3%

The strategic move used for our analysis combine the two locations, with feed innovation and segmentation strategy. This lead to the following income statement for Z-CO Farm, as it is presented in Table 4.7.

Table 4.7 Projected Income Statement for Z-CO Farm

	KANANGA	KINSHASA	TOTAL
COSTS			
Final hens' number	12,232	15,725	27,957
Layers' feed quantity (Kg)	528,401	679,320	1,207,721
Eggs' Trays number	114,487	147,186	261,673
Initial chicks' number	14,390	18,500	32,890
Chicks Cost	\$ 19,200.00	\$ 28,000.00	\$ 47,200.00
Rearing cost (Pullets feeding)	\$ 102,000.00	\$ 148,750.00	\$ 250,750.00
TOTAL REARING COSTS (1)	\$ 121,200.00	\$ 176,750.00	\$ 297,950.00
Layers' feed cost	\$ 264,384.00	\$ 462,672.00	\$ 727,056.00
Other costs	\$ 20,400.00	\$ 29,750.00	\$ 50,150.00
Marketing and labelling cost	\$ 31,983.12	\$ 31,674.83	\$ 63,657.95
TOTAL OPERATING COSTS (2)	\$ 316,767.12	\$ 524,096.83	\$ 840,863.95
TOTAL COSTS (3)	\$ 437,967.12	\$ 700,846.83	\$ 1,138,813.95
REVENUES			
Total Eggs Sale	\$ 639,662.40	\$ 842,341.50	\$ 1,482,003.90
Culled hens' sale	\$ 20,400.00	\$ 37,187.50	\$ 57,587.50
TOTAL REVENUES (4)	\$ 660,062.40	\$ 879,529.00	\$ 1,539,591.40
OPERATING MARGIN (4)-(2)	\$ 343,295.28	\$ 355,432.18	\$ 698,727.46
EBIT (4)-(3)	\$ 222,095.28	\$ 178,682.18	\$ 400,777.46
TAXES (20%)	\$ 44,419.00	\$ 35,736.43	\$ 80,155.49
INCOME	\$ 177,676.28	\$ 142,945.75	\$ 320,621.97
INCOME %	26.9%	16.3%	20.8%
INCOME PER HEN	\$ 14.52	\$ 9.09	\$ 11.46

4.2.4 Decision tools

We begin with the estimation of five years net revenue using the foregoing assumptions. The above income statement is based on global a quantity of 27,900 hens for both locations. This number will, however, increase to 40,000 in the fifth year according to Table 4.1 forecast.

The investment year will support equipment and building costs, along with rearing costs of the first generation. However, when calculating profitability ratios, only half of building and equipment cost is considered, as their total lifetime is 10 years.

The first year of production will bear laying net revenue of the first generation (12 months) and rearing cost of the second generation (6 months), etc.

The estimated NPV of the investment is about \$1,404,290 and the internal rate of return (IRR) is **74%**. The cost of capital is set to 20%, according to our assumptions, given the high rates applied by local bank for lending to agricultural projects.

The investment in this laying farm model appears to be profitable, provided that the feed and segmentation strategies are followed, and that the investment be split in different location to take advantage of niches. Table 4.9 summarizes NPV and IRR for the different scenarios contained in Tables 4.5 and 4.6, and help to visualize impact of alternative solutions.

It appears clearly that a small egg farm operating in Kinshasa is no longer viable, its NPV and IRR being negative. A feed cost cut of 10% by on-farm processing will not improve the profitability alone. Market segmentation only can make the difference by allowing to charge premium price for special eggs.

In Kananga, however, it is possible to operate profitably with market conditions regarding feed outsourcing and prevalent market eggs' prices. The implementation of feed innovation strategy have a tremendous profit potential. Segmentation can also be pursued, but with lesser impact than feed low cost strategy.

Table 4.8 Projected five-year income statements

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
COSTS						
Final hens number	-	27,957	30,752	33,827	37,210	40,931
Layer feed quantity (Kg)		1,207,721	1,328,493	1,461,342	1,607,476	1,768,224
Egg Trays		261,673	287,840	316,624	348,287	383,115
Initial chicks' number	32,890	36,179	39,797	43,777	48,154	52,970
Chicks Cost	\$47,200.00	\$51,920.00	\$57,112.00	\$62,823.20	\$69,105.52	\$76,016.07
Rearing cost (Pullets feeding)	\$279,565.00	\$275,825.00	\$303,407.50	\$333,748.25	\$367,123.08	\$403,835.38
TOTAL REARING COSTS (1)	\$326,765.00	\$327,745.00	\$360,519.50	\$396,571.45	\$436,228.60	\$479,851.45
Layer feed cost	-	\$727,056.00	\$799,761.60	\$879,737.76	\$967,711.54	\$1,064,482.69
Other costs	-	\$50,150.00	\$55,165.00	\$60,681.50	\$66,749.65	\$73,424.62
Marketing and labelling cost	-	\$63,657.95	\$70,023.74	\$77,026.11	\$84,728.72	\$93,201.60
TOTAL OPERATING COSTS (2)	-	\$840,863.95	\$924,950.34	\$1,017,445.37	\$1,119,189.91	\$1,231,108.90
TOTAL COSTS (3)=(1)+(2)	\$326,765.00	\$1,168,608.95	\$1,285,469.84	\$1,414,016.82	\$1,555,418.51	\$1,710,960.36
REVENUES						
Total Egg Sale	-	\$1,482,003.90	\$1,630,204.29	\$1,793,224.72	\$1,972,547.19	\$2,169,801.91
Culled hens sale	-	\$57,587.50	\$63,346.25	\$69,680.88	\$76,648.96	\$84,313.86
TOTAL REVENUES (4)	-	\$1,539,591.40	\$1,693,550.54	\$1,862,905.59	\$2,049,196.15	\$2,254,115.77
OPERATING MARGIN (4)-(2)	-	\$698,727.46	\$768,600.20	\$845,460.22	\$930,006.24	\$1,023,006.87
EBIT (4)-(3)	-	\$370,982.46	\$408,080.70	\$448,888.77	\$493,777.65	\$543,155.41
TAXES (20%)	-	\$74,196.49	\$81,616.14	\$89,777.75	\$98,755.53	\$108,631.08
INCOME	\$(326,765.00)	\$296,785.96	\$326,464.56	\$359,111.02	\$395,022.12	\$434,524.33

<i>Building and Equipment (half cost)</i>	\$ (120,000.00)
<i>Total initial costs</i>	\$ (446,765.00)
NPV	\$1,404,290.09
IRR	74%

Table 4.9 NPV and IRR for different investment scenario

<i>LOCATION</i>	<i>Year 0</i>	<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>	<i>Year 4</i>	<i>Year 5</i>	<i>NPV</i>	<i>IRR</i>	<i>APPLIED STRATEGY</i>
<i>KINSHASA</i>									<i>MARKET CONDITIONS</i>
<i>KINSHASA</i>	\$(236,750.00)	\$ 13,486.50	\$ 13,486.50	\$ 13,486.50	\$ 13,486.50	\$ 13,486.50	\$(163,680.92)	-31%	<i>FEED INNOVATING</i>
<i>KINSHASA</i>	\$(236,750.00)	\$ 67,832.10	\$ 67,832.10	\$ 67,832.10	\$ 67,832.10	\$ 67,832.10	\$(28,242.08)	13%	<i>MARKET SEGMENTATION</i>
<i>KINSHASA</i>	\$(236,750.00)	\$113,867.35	\$113,867.35	\$113,867.35	\$113,867.35	\$113,867.35	\$ 86,485.90	39%	<i>FEED AND SEGMENTATION</i>
<i>KINSHASA</i>	\$(236,750.00)	\$168,212.95	\$168,212.95	\$168,212.95	\$168,212.95	\$168,212.95	\$ 221,924.75	65%	<i>MARKET CONDITIONS</i>
<i>KANANGA</i>									<i>FEED INNOVATING</i>
<i>KANANGA</i>	\$(181,200.00)	\$ 97,725.37	\$ 97,725.37	\$ 97,725.37	\$ 97,725.37	\$ 97,725.37	\$ 92,548.89	46%	<i>MARKET SEGMENTATION</i>
<i>KANANGA</i>	\$(181,200.00)	\$224,541.56	\$224,541.56	\$224,541.56	\$224,541.56	\$224,541.56	\$ 408,597.26	122%	<i>FEED AND SEGMENTATION</i>
<i>KANANGA</i>	\$(181,200.00)	\$130,697.58	\$130,697.58	\$130,697.58	\$130,697.58	\$130,697.58	\$ 174,721.47	66%	<i>MARKET CONDITIONS</i>
<i>KANANGA</i>	\$(181,200.00)	\$257,513.77	\$257,513.77	\$257,513.77	\$257,513.77	\$257,513.77	\$ 490,769.84	140%	<i>FEED AND SEGMENTATION</i>

4.3 Sensitivity Analysis

From the Table 4.9, we ran scenario manager with four parameters in five states hypothesis. The changing variable in each scenario were:

- Mortality rate
- Laying rate
- Layers' feed price
- Eggs' tray price

The result of scenario manager is displayed in Table 4.10. Changes in these factors give various levels of IRR, from 98% in the very good state to negative 24% in the bad. Even change in one variable alone can cause great difference on the NPV value.

Table 4.10 Scenario analysis for NPV and IRR

Scenario Summary		Current Values:	VERY GOOD	GOOD	FAIR	POOR	BAD
Changing Cells:							
Mortality rate		15%	13%	14%	15%	16%	16%
Laying rate		78%	85%	82%	78%	75%	75%
Layer feed price		\$0.671	\$0.600	\$0.680	\$0.680	\$0.700	\$ 0.750
Eggs tray price		\$6.31	\$6.40	\$6.10	\$5.80	\$5.50	\$ 5.20
Result Cells:							
NPV		\$1,617,151.19	\$1,924,988.19	\$1,431,768.70	\$1,210,670.30	\$921,541.63	(\$287,994.83)
IRR		76%	98%	63%	46%	22%	-24%

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

CHAPTER V: EXECUTION BY BLUE OCEAN

The results in the foregoing chapter shows that it is economically feasible to produce specialty eggs and market them in specific market segments of the DR Congo market. How Z-Co Farms achieves the foregoing outcomes is the subject of this chapter.

Global strategic approaches only could help re-design the entire business with in mind the ultimate objective of making competition of large farm and imports irrelevant. This strategy can be based on following theories:

- The positioning or warfare theories, backed by Michael Porter, expose different responses when facing a competition threat in various cases. The five forces approach will then be used to describe the competitive environment and possible positioning strategies.
- The blue ocean theory: Blue Ocean can be defined as the process of creating great and peaceful markets, out of crowded ones, by focusing on big picture, looking across industries, tapping in latent demand and going beyond existing competition and boundaries (Kim and Mauborgne 2005). It differs from classic marketing strategies embedded in the tradeoff between low cost and differentiation or segmentation. The blue ocean theory will be the main frame of this work.

In the center of Blue Ocean strategy is “Value innovation”: the process of creating value for both the consumer and the company simultaneously. By creating the leap in value for both, it opens new and uncontested market spaces (Kim and Mauborgne, 12).

The common thinking established a value-cost trade off dogma, meaning that a business must choose between pursuing a high valued product at a high cost for a targeted customers’ segment or adopt a low value and low priced products strategy. The Blue Ocean’s value innovation at opposite brings together high value and low cost, driving down all the company cost while creating a greater value for buyers.

Differences between Blue Ocean and “Red Ocean” strategies are summarized in figure 5.1. The execution part of this work will opportunistically look at how a Blue Ocean approach could help small scale layers farm in DR Congo to sustain competition and extend their business.

Figure 5.1 Red Ocean vs Blue Ocean Strategy

Red Ocean Strategy	Blue Ocean Strategy
Compete in existing market space	Create uncontested market space
Beat the competition	Make the competition irrelevant
Exploit existing demand	Create and capture new demand
Make the value-cost trade-off	Break the value-cost trade-off
Align the whole system of a firm’s activities with its strategic choice of differentiation or cost	Align the whole system of a firm’s activities in pursuit of differentiation and low cost.

Source: (Blue Ocean Strategy 2005, 18)

5.1 Blue Ocean tools

This section explores how to use two specific Blue Ocean strategies to secure the market and protect and expand Z-Co’s position in the DR Congo market. The “strategy canvas” tool will be used to design competitive marketing strategy for small scale layers farms in DR Congo.

5.1.1 The eggs’ industry strategy canvas

The strategy canvas is a tool that help visualize strengths and weakness of an industry in satisfying its consumers’ needs. It allows to capture factors or elements that are crucial to run a successful business in a given industry. As the purpose of this thesis is to outline how a small layers’ farm can be profitable and sustain high competition in a developing country, it is obvious that the first step must consist in defining success factors in egg industry. We prefer to consider the egg market or industry, instead of the farming sector, as farms are just part of the players in this market. First step is then to unveil the success factors driving this industry.

Success factors in the eggs' market

The following elements have been identified as success factors in the DRC egg industry. These factors are identified from the consumers or customers point of view:

- Pricing: the market price of eggs is volatile, and farmers or suppliers who are able to sell at higher prices than the market get a profitable advantage. This is the case for supermarket suppliers and exporters to neighboring countries
- Eggs size and uniformity: consumers prefer bigger and uniform eggs, they are quite indifferent regarding white or brown color.
- Cleanness and bacteria free: cleanness of eggs is an important feature when targeting high revenue customers.
- Freshness and storability: supplying fresher eggs, direct from farm, is also a success factor in the egg industry, as they can be kept longer in the ambient tropical climate.
- Availability: the capability to supply regular customers, especially in remote markets, appears obviously as an element of performance.
- Traceability: consumers prefer to know where were the eggs produced, and some have absolute preference for local farm origins.

With these critical attributes defined, it's possible to draw the strategy canvas of the egg industry in DRC market. It could then be easy to visualize how each farm or category of suppliers perform regarding these criteria (big modern farms, small farms, importers of frozen eggs, importers of fresh eggs).

Visualizing the strategy canvas

The findings of the strategy canvas of DR Congo egg industry are presented in Figure 5.2. It appears from this canvas that all players have similar moves but with key differences. Significant differentiation can be made by small farms by acting on “Cleanness”, “Delivery”, “Freshness”, “Feed Cost” and “Hinterland Supply”. Surely it could not be possible to embrace all these facets, focusing on few key factors will be necessary.

Concentrating on relevant factors, choosing divergence elements and using a compelling tagline will then be the key features of small farmers’ strategy in this environment. The canvas can be made also for such a specific market as Kinshasa region, and it will appear as follow.

Figure 5.2 Strategy canvas for DR Congo’s eggs industry



The blue line in the Strategy Canvas express the ideal situations for the small farmers.

They could be as various as:

- Reach the same price level as major farms;
- Ameliorate management and feed quality to attain higher regularity on egg size and improve laying rate;
- Implement a cleaning and disinfecting equipment to have their eggs cleaner and emphasize on the sanitary feature of their eggs;
- Initiate home delivery, and combine this with additional items produced in or near the farms, like vegetables;
- Reduce feed cost by making it, alone or together with other farms, and innovate by use more of cheap local ingredients;
- Expand in the hinterland markets by targeting or by relocating assets, which is easier for small farms than to giant ones;
- Initiate dating and branding by stamping eggs that will ensure traceability and freshness;
- Promote and invest in 6-eggs' trays that could be well priced and easy to sell to a greater variety of customers.

Nevertheless, implementing a strategy needs to focus on a few features that could have more lasting effects. It is therefore important to check what elements to Eliminate, Reduce, Increase or Create.

5.1.2 Designing a blue ocean strategy for the small scale eggs' farming

We came to stress out one strategy that combines relevant factors enlightened by the industry's canvas. The retained blue ocean strategy for small layers' farms could consist on following simultaneously three tools and sub-strategies:

- stamping (dating and branding)
- extending in hinterland markets
- innovating in feed's formulation and cost.

The objective of this strategy is to create sustainable value innovation for small farms in the competitive environment of DRC's egg market. Value innovation implies creating value for both the company and the customer. The final impact of this combination is to reduce operating costs (feed cost), create differentiation by stamping and dating eggs and expand in hinterland markets.

A. Stamping and branding tool

There is no stamping or dating practice in the country. Introducing it would be innovating and capture consumers' attention. Stamping will enable branding, and ensure local origin and freshness. Customers today have no means to verify the freshness of purchased eggs, as no dating is applied. There is also no regulation or sanitary measures limiting the age of table eggs to be sold in the market. For ordinary people, this may seem of minor value, as most of them are interested by the low price. But the mentality is changing, and it will pay to seize opportunity of this incoming change in consumers' preferences.

For the segment targeted in our analysis however (medium and high revenues families), they will pay attention on the origin and proof of eggs' freshness, and they would pay a price premium for these "sure and safe" eggs. In addition, stamping (branding and dating) will give to these ZCO Farm' eggs differentiated value and visibility which will change its positioning in supermarkets and in consumers' mind, throwing away competition.

Stamping could be implemented at affordable cost with manual eggs' stampers. The limiting factor for eggs' stamping in developed countries has been the labor cost (Cooper 2008). Cooper calculated (in the British environment) the cost of the two options available to producers: hand or automatic stamping of eggs. On average, machines are likely to cost \$20,000 to \$40,000 a farm on average, although this will vary according to the size of the farm and number of machines required. Large producers are likely to face higher capital costs on

automatic machinery, but no extra labor costs, while smaller farmers may incur little outlay but higher labor costs when using manual stampers.

Given the very low labor cost in DRC (around 150\$ a month), it is easier and cheaper to implement in-farm stamping by small or medium units than big farms.

Adversely, stamping could be easily imitated by other farms and become less a distinctive trait. The strength of the brand or farm name will still have a great value, especially when the farm succeeded on creating customers' loyalty. Being among leading farms in introducing stamping and traceability will give a first-move advantage.

If the stamping practice is broadly followed or implemented as a sanitary measure it could enlarge the market by making it difficult to compete than imported eggs, regarding delays and traceability. Imports will surely have a great disadvantage as they have to face higher transportation delays. At that extent, stamping and dating could become indirect barrier to imports. DR Congo has not implemented protective measures against poultry products imports like in Zambia (Mwansa 2013), and extended stamping may appear ultimately as kind of self-protection measures. In Europe, on-farm stamping appeared to be a powerful tool for free range eggs' producers in fighting fraud from imported battery eggs.

B. Targeting hinterland markets strategy

While competition is fierce in the capital city Kinshasa with 25 small and medium farms, 3 big farms and imported frozen eggs, there are many interesting small and empty markets inside this big country with higher prices. By splitting and relocating some of their production assets in the hinterland towns, small farmers can benefit from these customers without any competition.

The advantage for the hinterland's customers will be to have fresher eggs at a slightly lower price (price value to consumers). It will increase the egg consumption level, widening again the market at a profitable value. The reduced prices for these consumers compared to

actual prices will still be higher than the Kinshasa's market prices. So both consumer and farmer will take advantage of this price.

Moving assets is essential to seize opportunity of these blue ocean markets of numerous towns inside the country. And this is easier to implement by small farms than big ones. It can be done with simple poultry houses, well ventilated, in regions where lands and local building materials are cheap (clay and wood). The hens can be kept on deep litters, but with adequate drinkers and feeders equipment.

One challenge will certainly be how to carry day-one chicks to these remote hinterland farms. All chicks are imported from Europe, South Africa and Zambia. It is however possible to bring chicks to main towns inside the country by airways, after a few days of acclimation at the entry point. It could be preferable to re-ship the chicks inside the country after one week upon their arrival, as the first week of management is critical for future layer's performance. Fortunately flying time inside is usually shorter, around one hour and half from Kinshasa to Kananga.

C. Considering innovation in feed formulation

The cost of feed is the most limiting factor in poultry farming in DRC, where two feed processors are dominating the market in Kinshasa, being themselves the biggest layers' farms..

The feed innovation axle of this Blue Ocean strategy aims to reduce the overall cost while maintaining high production of quality premium eggs. It's important to emphasize quality or balanced feed at this point, as cutting feed cost alone could lead to laying inefficiency if it is not properly managed. So innovating in feed has to be studied carefully with relevant analyses.

The key finding in this implementation is that the cost of main ingredients is much cheaper in the hinterland locations, near the agriproducts production areas and where also there is also markets expansion potential without competition.

These prices make it possible to have a feed at a lower price of \$430 per ton, with a balanced formulation, even lower than the Zambian feed price. Ingredients' prices, quality and availability are key to have affordable and adequate layers' feed.

The location of the ingredients' sourcing near consumers' area, as in Kananga, located in the south center of DRC, allows to broaden market coverage. Feed made from there could reach other locations in west and east directions, along the main national road (National 1). Small poultry farms in hinterland cities and town (Tshikapa, Mbujimayi and Mweneditu) could benefit for this cheaper feed. With careful supply chain design, this local feed could have potential to reduce a little feed cost for small layers farms even in Kinshasa and Lubumbashi. One \$430 per ton feed produced in Kananga could be priced around \$720 in Kinshasa, including the transportation costs.

This overall strategy would result in reduced cost, distinguishable labeled fresh eggs and occupying new areas free of competition, all that allow to charge a good price for both farmers and customers, while targeting high and medium revenues families.

5.2 Risk Management Strategies

This final section explores how Z-Co may address the potential for unforeseen risks that are outside its control.

5.2.1 Controllable risks

In this category, we can range risks related to factors identified in the scenario manager above. These are morbidity risk, production risk, input cost risk and sale price risk.

- a) The morbidity risk depend first on quality of chicks' sourcing. A reliable supplier, with a long business relationship helps reduce the initial mortality rate. Avoid a change of the supplier without a rigorous due diligence. The good practice management will do with normal mortality if all sanitary and nutrition recommendations are followed up.

- b) The production risk, expressed by change in laying rate, can also be controlled with good management. The ability to hire good managers and implement attractive incentives will be the best way to manage this risk.
- c) Feed cost and sale price are the major risks. They can be partially controlled by implementing the outlined blue ocean strategy. However, even when making feed, a change in ingredients prices is a real potential risk. It is therefore important to adopt a strategy of reinvesting cash flow in buying ingredients in advance in peak periods, and building.

5.2.2 Out of control risks

The following list shows some of the factors that can slow progress or even endanger the entire project in the Congolese environment.

- a) Finance risks: the availability of finance locally can restrict implementation of the project. Banks loan interest is very high, ranging from 14% to 21%, and this is a real risk for an investor. To manage this risk, the business plan must be based on certain funds, and on projects that have sufficient high IRR so that interest costs could be supported. Another strategy is internal financing, by reinvesting cash flow instead of payout.
- b) Threat of new entrants and imports: this threat become irrelevant when all above blue ocean strategies are followed up.
- c) Political and war risk: the country is still among fragile States of the World and political and war risks are not completely eliminated, even if their likelihood is reduced. Fears still arise when coming close to general elections, and many businesses tend to be more prudential at these time. However, it's usually eastern parts of the country, choosing locations when splitting farm activities is the key. For this purpose the West part (Kinshasa) and center (Kananga) are safer. Another

strategy is to promote contracting with local partners, sharing the risk with them, while they are more capable of protecting assets in possible troubled moments.

- d) Absence of strong insurers: this is a serious risk, as the insurance business is not yet liberalized in DR Congo, where it is still a monopolistic activity of a state owned company (liberalization law scheduled in Parliament). The alternative strategy is again grow progressively by reinvesting cash flow, and be self-insured.

CHAPTER VI: SUMMARY AND CONCLUSIONS

Viewed from an international and global perspective, the egg market or consumption focus mainly on consumption per capita data and African countries, especially DR Congo, appear at the bottom of that list. It can't be seen as a suitable place for investing in layer farming.

However, developing countries, among them Africa, have shown to have the greater annual increase in egg production than Northern countries, and they represent today 67% of the World egg output, while this share was only about 22% forty years ago. Similarly, consumption per capita increased by 11% in Africa, while it decreased by 3.4% in European Union.

There is clearly a potential for growing and profitable business in developing countries' market for laying farms. Nevertheless, this sector is concentrated around capital city, and dominated by few big farms. Small sized farms find it difficult to sustain competition and battle against imported frozen eggs in countries like DR Congo.

The objective of this thesis was to examine and design possible strategies for a small layers farm to operate successfully and sustain competition in the market environment of a low revenue country. Z-CO Farm, operating in Kinshasa's South region in DR Congo illustrated this essay.

The thesis outlined main features of the eggs' market in that country, including very high feed cost, big farms' ownership of feed mill units, high eggs' prices discrepancy between markets and localizations, low quality and undifferentiated products, poor regulation about standards of imported eggs, high transportation costs and absence of serious suppliers in the hinterland markets. Within this context and the existing marketing system, small farms have been operating on the edge of their breakeven points, leading to regular shutdown.

Based on available Z-CO Farm and country's data, this research focused on finding ways to improve the overall level of profitability by targeting production and marketing levels.

A major link between production and the marketing or pricing stages is obviously feed quality and cost management. High feed quality is required for better laying result, while its cost appears to be the main driver of eggs' pricing. It is therefore important to avoid the tradeoff between quality and cost of feed, and find way to improve or maintain nutrients' quality of hens' feed while cutting down its cost.

The thesis showed up that this is possible in the context of DR Congo for small scale farms. Opportunely, they to take advantage of their small size, flexibility and low labor cost to operate differently than the big ones and compete even with imported eggs.

This strategy needs them to redesign their global business perspective, by targeting primarily medium and high revenue and offering premium eggs at better price. One strategic tool would be the stamping and dating of eggs in the farm. While this has not been fully adopted in developed countries due to its cost, it's oddly more feasible in small farms given the low labor cost prevailing in DRC and sub-Saharan countries. Branding and dating would provide consumers with the traceability, safety and freshness that is not easy to be offered by bigger farms and imported eggs' suppliers. This would enable farms practice premium prices and still be cheaper than the maximum applied prices, by simply cutting off middlemen' costs.

The most beneficial move would then be to take advantage of wide free market space of the hinterland. These landlocked regions in the country are areas of production for many agricultural commodities which can be used efficiently in hens' feed at a very low cost. The thesis showed up that moving partially production assets in hinterland towns would have twice the benefit of the Kinshasa market, by combining low feed cost with local ingredients, better price, traceable fresher eggs and absence of direct competition.

This global strategy is a real blue ocean, as it would help small farmer to operate successfully disregarding competition by offering premium and traceable eggs while lowering cost and expanding in markets' spaces free of direct completion. The hinterland markets are

small niches, not enough interesting for big farms. And small farmers can more easily move or divide their assets to invest in some the hinterland locations, to take advantage of niches and low cost inputs.

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