REPUBLIC OF RWANDA

Ministry of Agriculture and Animal Resources (MINAGRI)

STRATEGY & INVESTMENT PLAN TO STRENGTHEN THE POULTRY INDUSTRY IN RWANDA

FINAL REPORT

JULY 2012

CONTENTS

LIST OF ILLUSTRATIONS

List of Tables

List of figures

List of pictures

ACRONYMS

APEL	Programme d'Appui au Petit Elevage
ARMV	Association Rwandaise des Médecins Vétérinaires
BPR	Banque Populaire du Rwanda
BRD	Banque Rwandaise de Développement
DRC	Democratic Republic of Congo
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategy
FAO	Food and Agriculture Organization of the United Nations
HACCP	Hazard Analysis Control of Critical Points
IMF	International Monetary Fund
ISAE	Higher Institute of Agriculture and Animal Husbandry
ISAR	Institut des Sciences Agronomiques du Rwanda
MDGs	Millennium Development Goals
MINAGRI	Ministry of Agriculture and Animal Resources
MINECOFIN	Ministry of Finance and Economic Planning
NAEB	National Agricultural Export Development Board
NGO	Non-Governmental Organisation
PSTA	Plan Stratégique pour la Transformation de l'Agriculture
PPP	Public-Private Partnership
RAB	Rwanda Agriculture Board
RBS	Rwanda Bureau of Standards
RDB	Rwanda Development Board
RPIA	Rwanda Poultry Industry Association
RTV	Rwanda Television
RWF	Rwandan Francs
SME	Small and Medium Enterprises
SWOT	Strengths, Weaknesses, Opportunities and Threats
UN	United Nations

EXECUTIVE SUMMARY

Livestock currently contributes between 25 and 30% of the Agricultural GDP of developing countries and that is expected to rise up to 50% over the next 20 years. 70% of the world's rural poor depend on livestock (mainly sheep, goats, pigs and poultry) as an important component of their livelihoods.

Livestock makes a disproportionally higher contribution to the income and welfare of the poorest smallholders, and particularly of women, and through them, children in such households. While meat consumption per capita in developed countries is around 80 kg per year, it hardly exceeds 32 Kg in Africa.

This study was initiated under the aegis of MINAGRI to strengthen and modernize the poultry industry in Rwanda within the period 2012-2017.

Following an overview on the global trends of the poultry industry worldwide, in Africa and in Rwanda, our strategic diagnosis underlines the potentialities of the sector:

- The framework for livestock development, namely the involvement of public authorities to develop the poultry industry;
- Relevance of the poultry sector in the development policies (EDPRS and MDG targets);
- Existence of foundations on which to build a modern poultry industry: involvement of private sector, professional organizations and ideal weather.

However, to fully maximize this potential, major constraints should be lifted:

- Village poultry, which constitutes the majority of the national flock, is in poor condition;
- National supply of day-old chicks, which is poor
- Poor nutrition, related to the absence of the poultry feed industry, the scarcity and high prices of feed ingredients;
- Health constraints;
- Absence of marketing strategies;
- Financial constraints (low access to credit);
- Institutional constraints.

The challenge of launching a modern poultry industry can be divided into five major objectives:

- Maintaining domestic market and increasing market share;
- Becoming regionally competitive;
- Developing export opportunities and accessing foreign markets;
- Increasing food security;
- Increasing incomes of small-scale producers, emergence of major poultry business farmers.

These challenges will be met through this vision: « **Making the poultry industry a flagship of the Rwandan livestock** ».

This vision will be achieved through 2 strategic axes:

- Enhancing poultry meat and eggs production;
- Marketing.

The strategic axes will include 7 components:

- Poultry nutrition;
- Supply of day-old chicks (Recovery and Implementation of hatcheries);
- Poultry Health and Biosecurity;
- Development of village poultry;
- Strengthening the institutional framework;
- Mastery of sanitary quality;
- Promotion of the poultry products.

A Monitoring Team will devise a framework for reporting and measuring progress, including the measurement of the following with regard to the Rwandan poultry industry.

The overall budget to achieve the strategic axes and lift the poultry sector of Rwanda to the rank of a successful performing industry should be around 9,177,850,666 RWF.

INTRODUCTION

Livestock currently contributes between 25 and 30% of the Agricultural GDP of developing countries and that is expected to rise up to 50% over the next 20 years.

While the poultry industry is growing seven times faster than smallholder livestock systems in emerging economies like Brazil and China, African livestock is still largely in the hand of smallholders.

Poultry industry in Rwanda is characterized by the coexistence of 2 systems: rudimentary village poultry and industrial poultry at its infancy, the 2 systems facing scarcity of inputs to fully exploit their potential.

The necessity of implementing a strong and sustainable poultry industry in Rwanda is made more relevant by the global context surrounding this Industry: since the 1960s, the global production of poultry meat has been growing faster than that of any other meat in both developed and developing countries. This growth pattern can be expected to continue because of the inherent efficiency in feed conversion and the lower production costs associated with intensive poultry production. Such production efficiency is particularly beneficial to developing countries, which tend to have limited agricultural resources but burgeoning, and often poor populations.

Moreover, the growing GDP and progressive urbanization of rural populations, as expected in developing countries in the coming years, are inevitably linked to increased meat consumption. This global context is to be anticipated to ensure food self-sufficiency, generate incomes for farmers and reduce trade deficits by reducing imports on a sustainable basis.

1 CONTEXT AND OBJECTIVES OF THE STUDY

The implementation of Poverty reduction strategies (PRS) in 1999 under the aegis of the UN and the IMF intended to provide essential links between the actions of national authorities, the assistance of donors and the results required to achieve the Millennium Development Goals (MDGs) of the United Nations to halve poverty between 1990 and 2015. Rwanda, as many other African countries, included livestock development as key pillars of its PRS.

Any policy or strategy for Livestock development strategy should be inserted within the framework defined by the major orientations of the Rwandan Government: Vision 2020 and PSTA II.

1.1 Physical context

Rwanda is a landlocked country of 26 338 km^2. The population growth of Rwanda is estimated at 2.9% per year. The population of Rwanda is 11,370,425 as of July 2011 estimations. [1] This population would increase to 15 million in 2020 and 20 million in 2030. Rwanda is characterized by the highest population density in Africa, about 407 inhabitants per km^2. Some areas reached a density greater than 1000 inhabitants/ km^2. The total cultivated land covering about 46% of the area of the country divided into small farms. Marshes occupy an estimated area of 165 000 ha including 112 000 ha of small wetlands (less than 200 ha) and 53 000 ha of large marshes. The total harvest area is approximately 94 000 ha or 57% of the area of the marshes of Country and represents about 8% of the acreage.

The climate is tropical and temperate with an average temperature of 19 ° C and rainfall annually ranges between 900 and 1600 mm. The country has a small rainy season from September to November and a rainy season from February to May. The short dry season is between December and January and the long dry season from June to mid September. Some parts of countries may suffer from prolonged drought affecting agricultural production and weakening the food security of populations that inhabit them.

1.2 Macroeconomic context

Despite this climatic advantage, Rwanda is one of the poorest countries in the world[2].

- The annual per capita income is 540 U.S. dollars.
- Over 60% of the population lived below the poverty line.
- Agriculture is a major source of foreign currency and livelihoods of people
- Still in its infancy, the secondary sector consists essentially in manufacturing and building and contributes 15% of GDP.
- The area tertiary sector is 47 % of GDP.
- GDP is approximately 3 277 RWF billions.

[1] Data from Index mundi. Available at http://www.indexmundi.com/rwanda/population.html

[2] Rwanda 2020

Today, Rwanda is at a crossroads of its development. The country has an overall planning framework to face the challenges of national Development and poverty reduction towards the year 2020. The vision 2020 which the government of Rwanda has undertaken identified key pillars:

- Good governance and a capable state;
- Infrastructure development;
- Human Resource Development and a knowledge-based economy;
- Private sector-led development;
- Regional and International integration;
- Productive high value and market oriented agriculture.

1.3 Objectives of the study

The overall objective is to develop an effective strategy for the development of the poultry industry in Rwanda. The specific objectives are fourfold:

- Assessment of the current state of the poultry industry by examining all actors along the value chain (from smallholders to retailers). This entails understanding the current and potential supply and demand of poultry in Rwanda, in quantitative and qualitative terms. In particular, there is a need to know the quantity and quality of the stock, a breakdown of production and estimated consumer demand, disease prevalence and risks, understanding the feeding industry, assessment of marketing, product development and export opportunities. There is a need to understand the capacity constraints of all stakeholders along this chain.
- Development of an effective and coherent strategy to enhance the poultry industry. The strategy should set out a 7-year strategy (to 2012-2018) of the poultry industry that importantly seeks to attract the private sector into the development of the industry. Details of short, medium and long-term priorities will be provided. This will also show key targets that could be achieved and the projected contributions by all stakeholders along the entire value-chain.
- Proposal of an implementation plan that will set out the projected investments needed to be made by the private sector and public sector to develop the poultry industry. This will also provide an Action Plan with detailed costs for MINAGRI, the recipient, to implement.
- Development of a 7 years business plan of Rubilizi hatchery and decentralized mini-hatcheries both in line with the national strategic dynamics of the poultry industry. During the past years, the Rubilizi hatchery seemed to be reduced to a day-to-day management without a substantial investment plan proper to transform it in a real profitable enterprise.

1.4 Comprehension of the terms of references

Two axes determine the comprehension of the terms of references:

- Exhaustive assessment of the poultry industry in its current form:
    - Quantity and quality of poultry;
    - Types of production;
    - Types of farmers;
    - Feeding possibilities;
    - Health situation;
    - Estimated consumer demand at district, national and regional levels (primarily EAC);
    - Genetic improvement possibilities;
    - Marketing and exports development opportunities.

- Set out what the poultry industry could look like over the next seven years:
    - Detailed investment plan in all the areas listed above, specifying the involvement of the private sector and outlining policies and institutional changes needed to boost the industry;
    - Mid-term strategy to exploit exports opportunities;
    - The strategy/investment plan will include an action plan for MINAGRI, setting out the investments to be made over the next 7 years to develop the poultry industry. Each output of the action plan will include baseline indicators, timeframe and costs;
    - A seven years Business plan for the recovery of the Rubilizi hatchery and the implementation of decentralized mini hatcheries including the following aspects: The framework of the business plan and the timeline; the extent of private sector involvement; financial profitability; management systems for the hatcheries; Market survey for one day old chicks and fertilized eggs in Rwanda and assess the current demand from neighboring countries close with Rwanda ;
    - The strategy should give a clear illustration of the potential impact that the poultry industry could have on agricultural growth and on achieving the MDG1 (given the current smallholder dominance) and meeting EDPRS targets.

2 METHODOLOGICAL APPROACH

The proposed approach includes 3 steps:

- Strategic diagnosis: This step includes literature review and field surveys (data collection phase of the sector at the national level with all stakeholders). Following the scanning of the sector, the strategic diagnosis will establish the SWOT of the poultry industry in Rwanda.
- Elaboration of the seven-year recovery plan: The development of the seven-year recovery plan to revive the poultry industry sector for the period 2012-2017 will start by defining the strategic vision. This is the consolidation of the action plans for areas as presented in the sections following the identification of areas. It will decline the axes according to these themes:
    - Activities and tasks to be undertaken;
    - Expected results;
    - Monitoring and Evaluation Indicators;
    - Resources Required;
    - Institution and / or lead agency to implement;
    - Actors involved direct and indirect;
    - Timeframe.
- Workshop and validation of the report. This step includes:
    - Writing and submission of the interim report (with business plans for Hatcheries in annex);
    - Organizing a workshop about the interim report to collect relevant amendments and improve the document;
    - Providing the final report.

3 GLOBAL TRENDS OF POULTRY INDUSTRY

3.1 Production of global poultry meat

The term global poultry meat includes chicken, turkey, ducks and fowls.

*Table 1 : World production of poultry meat (*1000 metric tons)*

2006	2007	2008	2009	2010	2011	% change, 11/10
69 464	73 663	77 053	77 320	81 012	83 328	2.9%
Poultry meat is expressed as ready-to-cook equivalent weight						

Source: USDA, 2011

Chicken meat accounts for 87 % of the total poultry meat production.

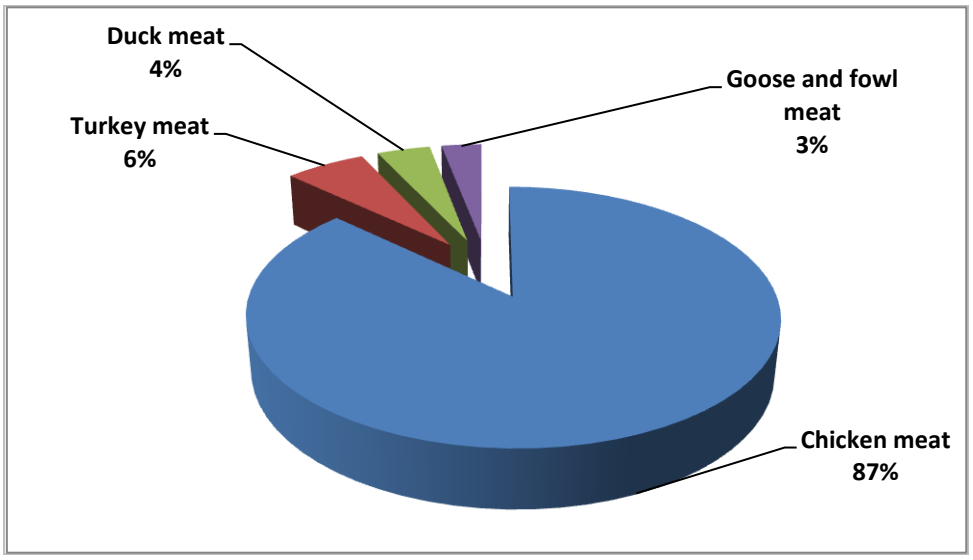


*Figure 1: World meat production by species (*Source: FAO, 2010)

It seems from first estimates that 2011 will prove to have been the year when the world's production of poultry meat exceeded 100 million metric tons for the first time in history.

This landmark is certainly possible, according to an early forecast from the FAO.

There can be no question from the figures available that the global volume in 2011, as expressed in carcase weight equivalent terms, will prove to have been substantially more than 98 million metric tons.

The world poultry meat production is led by the Asia-Pacific region (36.5 million metric tons), followed respectively by Latin America (21.7), North America (21.1), Europe (16.9) and Africa (4). USA and China account for 35% of the world broiler meat production.

The statistics regarding the world leaders in poultry meats are as follows:

Table 2 : *Countries/regions compared for chicken meat production, consumption and trade in 2010 (million metric tons)*

	Production	Consumption	Imports	Exports
USA	22	18	1	35
China	17	17	4	4
Brazil	16	12	0	36
EU_27	12	12	8	11
Mexico	4	4	7	0
India	3	4	-	0
Russia	3	4	8	0
Argentina	2	2	0	2
Iran	2	2	1	-
South Africa	2	2	3	0

Source: based on USDA and BMO Capital Markets

2011 appears significant for much more than taking world poultry meat production past a landmark tonnage and registering a key moment in the food versus fuel controversy. The latest global estimates also accord it a claim to fame in terms of human demographic figures as the year in which we can finally say that more than half of the people in the world now live in towns and this has been especially an Asian phenomenon and is joining with regionally strong income growth to drive extra meat consumption across Asia. For China, the data showed the urban share of the total population rising from 35% in 2000 to a current proportion of 47%. It also indicated that although China's consumption of broiler meat was on course to reach a record 10 kilograms per person/year in 2011, the amount eaten per person in towns and cities would be almost double the rural rate.

One particularly strong growth area is the poultry business in Brazil, where production has expanded due not only to higher export sales, but also to rising personal incomes and reduced competition from expensive beef.

3.2 World egg production

For egg production, a 2011 total of approximately 64 million metric tons looks likely. So, poultry meat output can claim to have expanded globally by about 43% since 2000, while the production of eggs has grown by more than 25% during the same period.

Global production is at more than 1.1 billion eggs per year. Just 15 countries have provided 70% of the world's eggs in 2011. The top 10 countries (see table 3) supplied nearly 65%.

Table 3 : *World's top 10 egg producing countries*

	Laying hens (*1000 birds)	Eggs produced per year (*1000)	Production weight (metric tons)
China	2 536 603	472 672 850	23 633 659
USA	339 526	90 408 000	5 349 100
India	242 000	57 800 000	3 200 000
Mexico	188 000	46 700 000	2 360 300
Japan	139 910	41 750 000	2 505 000
Russia	144 739	39 187 500	2 194 500
Brazil	276 005	38 437 700	1 921 890
Indonesia	238 527	23 550 000	1 059 270
Ukraine	110 000	15 747 500	913 400
France	51 480	15 305 000	918 300

Source: based on USDA and BMO Capital Markets

Asian region is the first producer (38.7 million tons), followed by America (12.9 million tons), Europe (10.2 million tons), Africa (2.7 million tons) and Oceania (0.3 million tons).

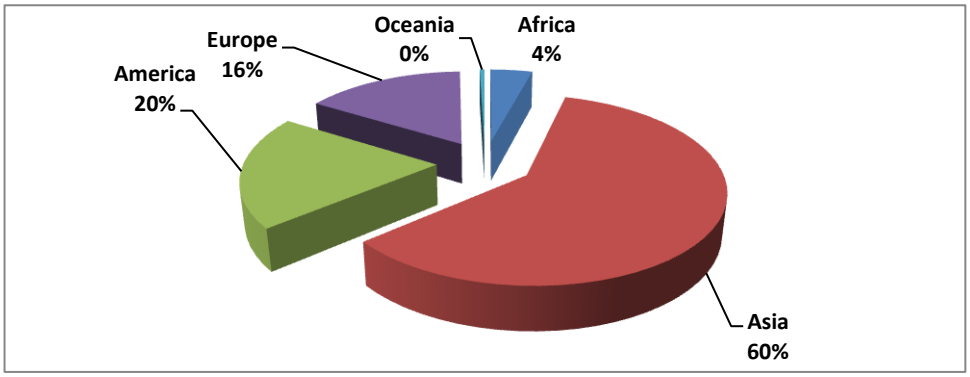


Figure 2: World egg production (Source: based on USDA and BMO Capital Markets)

3.3 Importance of poultry meat in the world meat market

3.3.1 International trade

3.3.1.1 Importance in meat Importations

World meat imports were estimated at 25.813 million tons in 2011. Poultry is the most imported meat with 11.288 million tons before beef (7.214 million tons) and swine (6.213 million tons). Importation of poultry meat in Africa represents 61% of total imports of meat.

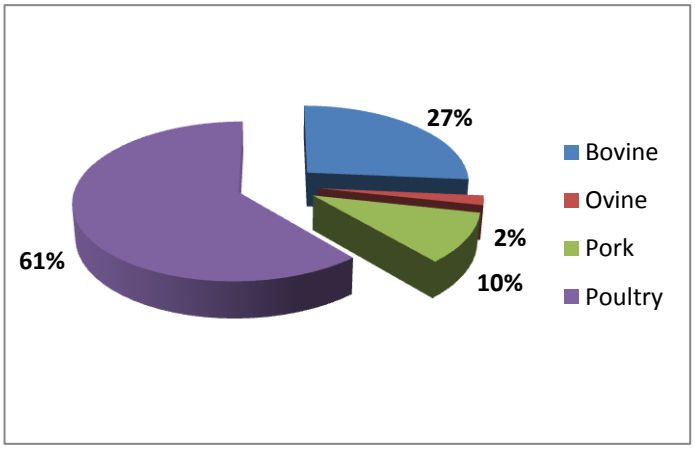


Figure 3 : Meat imports in Africa (Source: FAO, 2011)

3.3.1.2 Importance in Meat Exports

The exports leaders of total meat are United States (6.8 million t), Brazil (6.2 million t) and the European Union (3.4 million t). The greatest poultry exporters are:

- Brazil (4 098 000 t),
- USA (3 661 000 t),
- China (1 143 000 t)
- and EU27 (986 000 t)

The exports from Africa are estimated to 168 000 t, of which more than one third is from South Africa (50 000 t). Poultry meat exports represent 26% of total exports of meat from Africa.

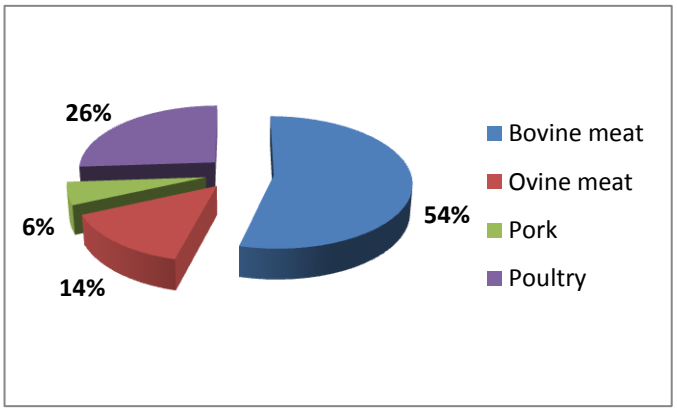


Figure 4 : Meat exports from Africa (Source: FAO, 2011)

3.3.2 About meat prices

Poultry meat is the cheapest in the world.

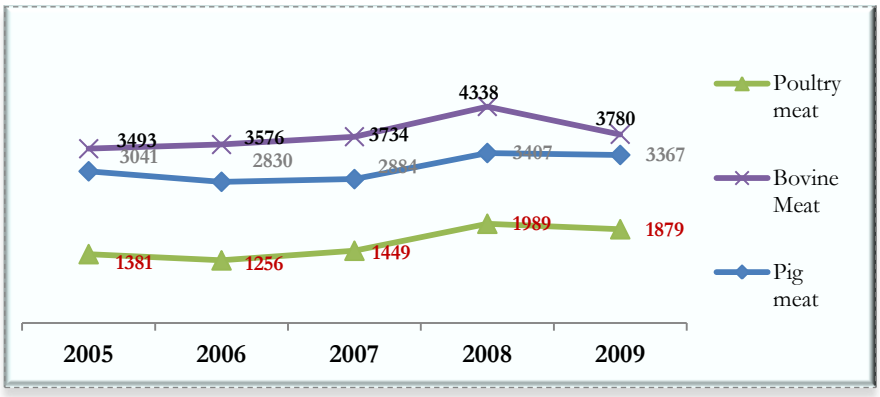


Figure 5 : International meat prices (Source: FAO, 2010)

3.4 Consumption forecasts

Meat and egg markets are expected to grow as world population near 7.5 billion in 2020.

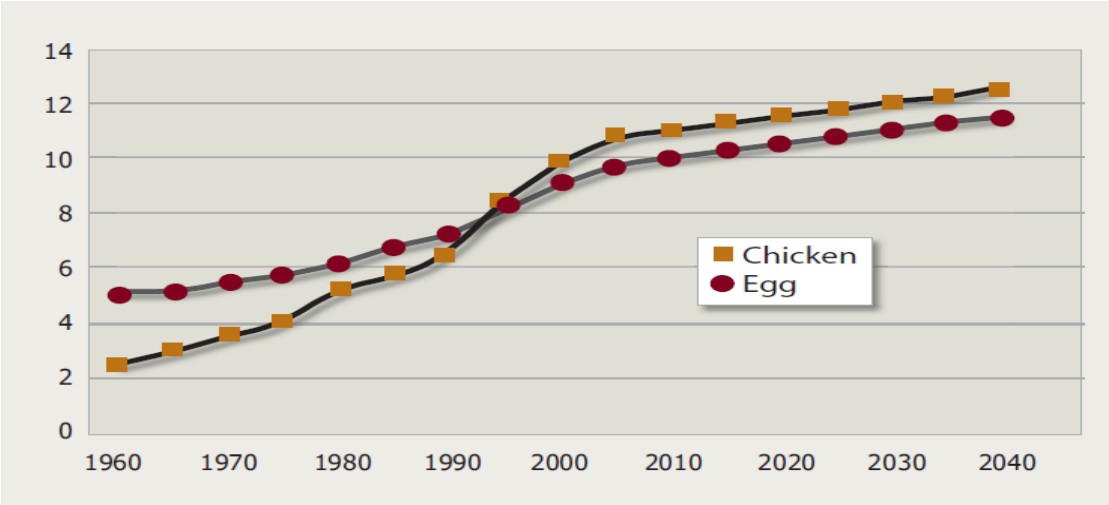


Figure 6: Projected rises in world consumption of chicken and eggs (kg per person per year) Source: based on USDA and BMO Capital Markets

Visions of the year 2020 from various sources suggest that the world production of poultry meat will approach 122.5 million metric tons and that 72 million metric tons of eggs will be produced globally by then. The potential market size by that time is indicated by a projected growth of the global human population from 6 billion in 1999 and approximately 7 billion in 2011, to a total of 7.5 billion people in 2020. With the projected increases in per-person consumption of poultry meat and eggs over the next decades, the global market's composition is forecast to change so that chicken rivals pork as the world's most popular meat.

The annual growth rate of the world population, after averaging 1.2% in the past decade, is expected to drop to 1.05% between 2011 and 2020. Meanwhile, the phenomenon of greater urbanisation will continue to reshape consumption patterns toward higher value processed products and convenience foods. Firm demand, particularly from developing countries in Asia and Latin America, is forecast to boost the meat market in the decade ahead. FAO says world meat production will grow at an average rate of 1.8% per year until 2020, adding some 60 million metric tons in the process, and that 78% of the projected growth in meat supplies will involve production primarily of poultry and pig meat in the developing countries.

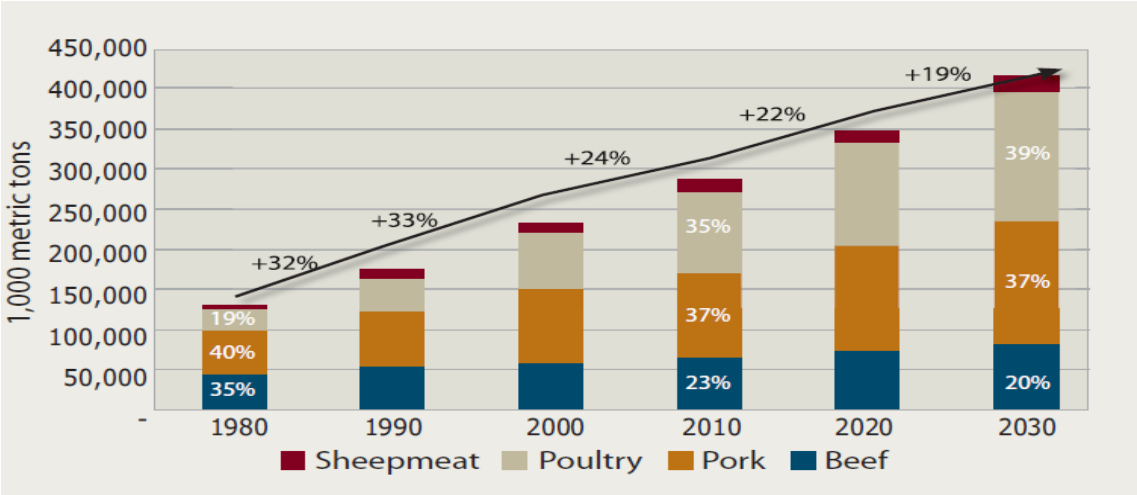


Figure 7: Growth in global meat market in 2030 Source: based on USDA and BMO Capital Markets

Egg forecasts of the percentage growth in production weight, comparing 2015 with 2011, range between only 0.6% in the European Union and 0.3% in Japan, to 9% to 10% in China and Indonesia, 14% in India and Turkey, and 17% in Brazil.

Already representing the fastest regional growth rate in egg production since 2000, Asia has also been identified as the driver of further increases in the global average number of eggs consumed per person annually. The current average is about 175 eggs per person, but may exceed 200 within the next eight to nine years. Currently, less than 2% of eggs are traded internationally compared to 60% of beef. However, demand from developing countries is expected to drive the total egg market to a 20% expansion over the next 10 years, bringing with it an increase in the trading of egg products.

3.5 Situation in Africa

3.5.1 Chicken meat in Africa

Of the 49 economies classified as low income (GNI per person per year of US$935 or less) in 2007, 33 were in sub-Saharan Africa. The 1.3 billion people living in low-income economies worldwide had an average annual income of just $578 and some earned as little as $110. Africa has more countries with high poverty rates than any other developing region. The population of sub-Saharan Africa has more than trebled since 1980 and currently stands at around 860 million out of a total for the continent of just over one billion.

By 2050, the population of this region will, at 1.75 billion, represent 19 per cent of the world total of around 9.5 billion, compared with about 13 per cent today. In the future, sub-Saharan Africa will experience dramatic urbanisation as its urban population increases from some 270 million to more than one billion in the next four decades.

The tryptic urbanization, economic growth and population growth will make Africa a region favorable to the development of poultry industry in the coming decades. Chicken meat production amounted

to 4 million tons. Maghreb (1.598 million tons) and South African (1.534 million tons) regions share 80 % of the global African production. West Africa is the third producer (512600 tons), followed by East Africa (199200 tons) and Central Africa (54900 tons). South Africa (1.3 million tons) is the major producer, followed by Egypt (633000 tons) and Morocco (502000 tons).

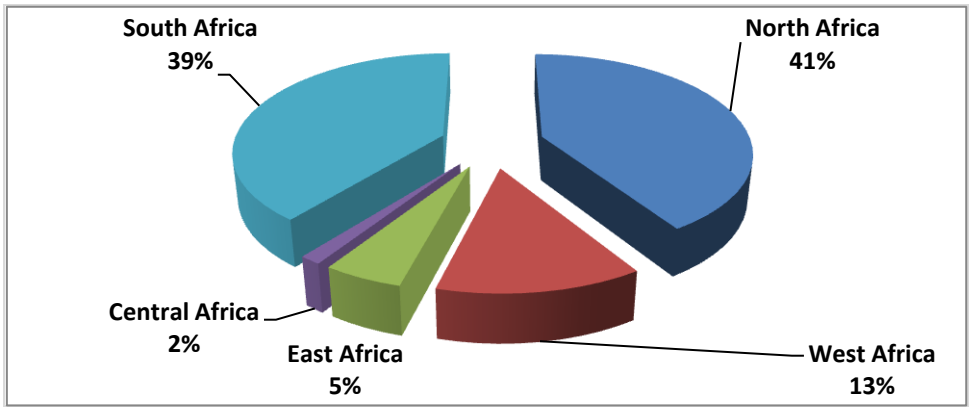


Figure 8: Chicken meat production in Africa regions (Source: FAO, 2010)

3.5.2 Egg production in Africa

The global production amounted for 2.7 million tons in 2010. Maghreb and West Africa are the major producing regions, both accounting for 57% of the total.

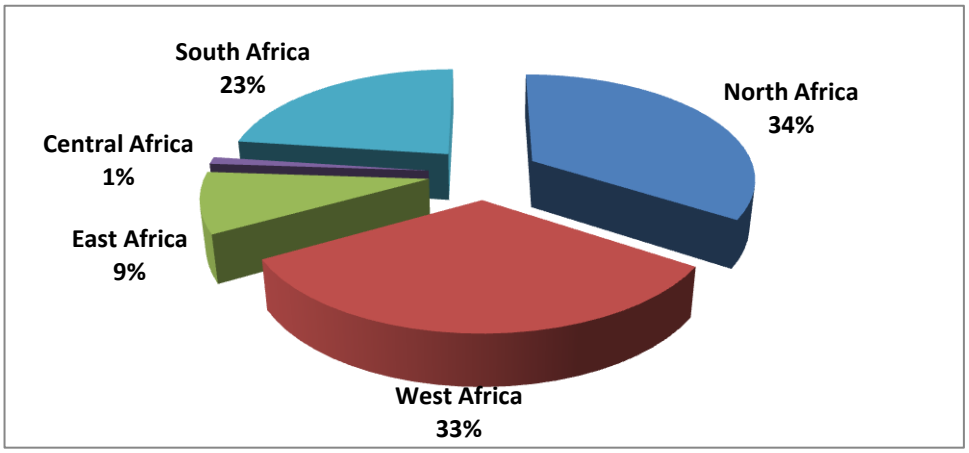


Figure 9: Egg production in Africa (Source: FAO, 2010)

Just five countries, Nigeria, South Africa, Egypt, Morocco and Algeria accounted for 1.83 million tonnes of eggs or 69 per cent of the regional total in 2010. It might be pertinent here to underline the point that in many developing countries around the world, a question mark hangs over the accuracy of the data, which is why the trend in production may be a better guide as to what is happening in an industry rather than paying too much attention to the output figures in any one year. Should the

figures be important to your needs, it would be wise to examine more closely the source of the data and also to look to alternative assessments.

3.6 Major findings

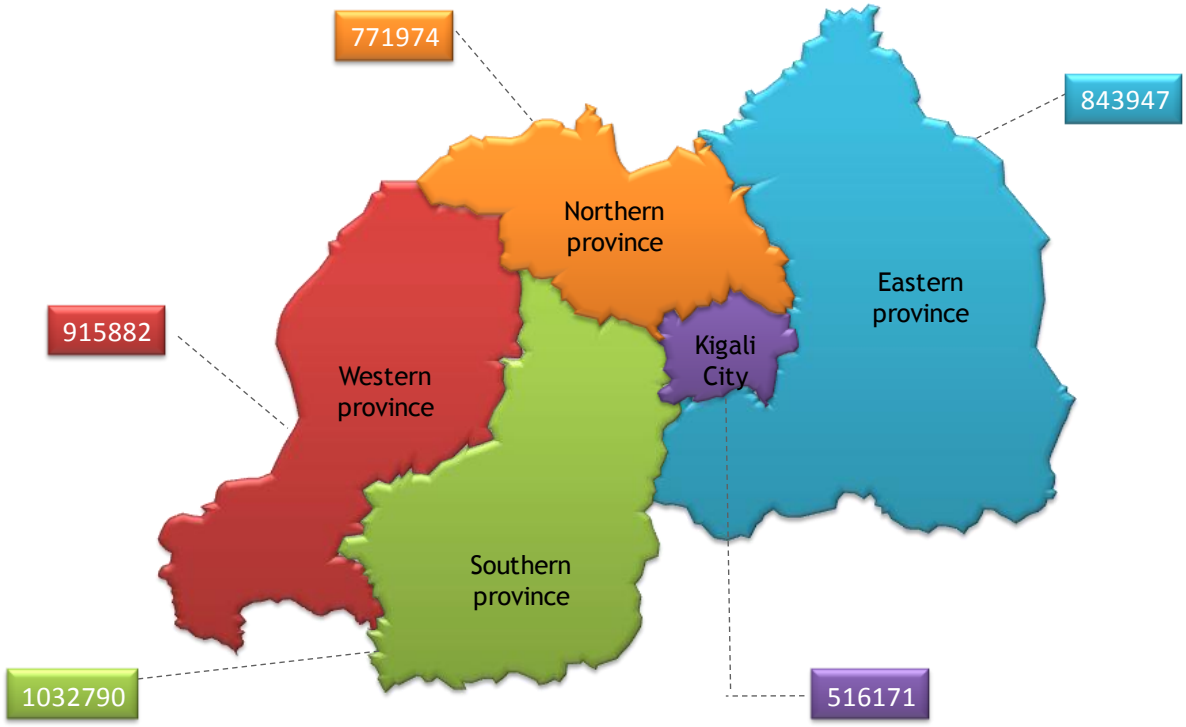
- Chicken meat is one of the most popular meat throughout the world;
- It is an important source of animal protein in developing countries;
- Competitiveness of the poultry meat remains closely tied to availability of corn, which explains the leadership of Brazil and USA;
- World production of corn will not increase significantly in the coming decade, resulting in an inflation of costs;
- The interest of bioethanol as an alternative to oil and the perverse effects of the environment of agricultural production will increase the prices of maize;
- The international egg market will have prosperous years until 2020 thanks to a boom in global exports;
- Export will be based on compliance with quality requirements, traceability, innovation and the respect of environment;
- Globalization dictates the rules of free trade and WTO members, particularly developing countries may suffer from their lack of competitiveness.

4 DIAGNOSIS OF POULTRY INDUSTRY IN RWANDA

4.1 Current situation

4.1.1 Poultry population

Poultry population amount for 4 081 000 heads: (chickens, ducks, turkeys…). Less than one third, 26.4%, (615,041 households) of the total agricultural households kept poultry. Only 4.1% (93,742 households) reared poultry as the only livestock species (Paul Heidloff, 2012).



Picture 1 : Distribution of poultry population in Rwanda (Source: Survey, RAB, 2010)

The chicken breeds found in Rwanda are:

- **Exotic breeds**
  - Layers: Leghorn, Sussex, Rhode Island Red, Derco, Isa brown, Norman. The laying performances range from 300 to 350 eggs per hen per year
  - Broilers: Cobb 500, Hubbard, Derco: in ideal conditions, the broilers reach 2 kg in 45 to 50 days

- **Local breed** (Inyarwanda)

The laying performance range from 40 to 100 eggs per hen per year and the adult weight is reached in more than 10 months. The other poultry species found are listed in the table below:

Table 4 : *Distribution of other poultry species (birds)*

Provinces	Ducks	Pigeons	Turkeys
South	1058	1147	128
West	2221	1038	59
North	1315	842	52
East	185	204	14
Kigali	1450	1731	64
Total	6729	4962	317

Source: Semi-annual report 2008 RAB (ex RARDA)

4.1.2 Type of production

This population is shared between 2 systems:

- a village poultry production system (system 4) which is largely predominant and;
- a commercial poultry production system (system 3).

The systems 1 and 2, which are indicators of the development level of the poultry sector are absent in Rwanda.

Table 5 : *FAO classification of poultry production systems*

Systems	Characteristics
System1	Industrial integrated system with high level of biosecurity and birds/products marketed commercially (e.g. farms that are part of an integrated broiler production enterprise with clearly defined and implemented standard operating procedures for biosecurity).
System2	Commercial poultry production system with moderate to high biosecurity and birds/products usually marketed commercially (e.g. farms with birds kept indoors continuously; strictly preventing contact with other poultry or wildlife).
System3	Commercial poultry production system with low to minimal biosecurity and birds/products entering live bird markets (e.g. a caged layer farm with birds in open sheds; a farm with poultry spending time outside the shed; a farm producing chickens and waterfowl).
System4	Village or backyard production with minimal biosecurity and birds/products consumed locally.

Source: FAO animal health and production division; poultry sector country review, 2009

4.1.3 Supply and demand of chicken meat and egg

The trend of the last 10 years shows that the production of meat and eggs increased regularly. Production of chicken meat (78.8 % of increase) was however much more important than for eggs (32 %).

Table 6 : *Chicken meat and eggs: production and imports*

	2000	2003	2004	2005	2007	2008	2009	2010
Chicken meat (tons of eviscerated weight)	1400	2000	2300	2300	2300	2500	2500	2500
Chicken meat production (tons)					4178	4176	4190	4400
Chicken meat imports (tons)					205	250	265	300
Egg production (tons)					2600	2800	2900	2900
Egg production (10^6 units)					29.61	36.05	34.29	36
Egg imports (10^6 units)					0.5	6	16.34	19.6

Source: FAO, 2010 and Dr Christine Kanyandekwe, RAB, 2011

4.1.4 Value chain of the poultry industry[3]

4.1.4.1 Value Chain for indigenous poultry and eggs

- Marketing

Producers sell live birds and eggs through two main channels: directly to consumers (at farm gate or at primary markets) and through village level primary collectors who in turn sell the products through the village level primary markets or delivered directly to retail outlets. Producers ferried live birds and eggs to primary markets using hand baskets while collectors used bicycles. More often than not primary collectors and at the primary markets sell live birds to retailers who operated in secondary markets in urban centres/cities. The secondary collectors in turn sold directly to consumers or to other traders or to hotels or restaurants. Retailers sell directly to consumers or to food outlets. Eggs are mainly used for further production at home although a small quantity is sold to travellers to Democratic Republic of Congo (DRC), Uganda and Burundi along the major highway. The eggs are packaged in a unique way using locally available materials. Like in many countries, live chicken are transported in public transport. During normal demand and supply season the off takes rates for indigenous birds was estimated to be 10% which increased to 50 to 60% during high demand season such as opening of schools, public holidays and festive seasons. High supply is also

[3] *FAO, 2010*

observed during the crop flowering season when farmers increase off take to avoid high confinement costs (feeds and housing) of birds throughout the day. Main marketing challenges include reduced income attributed to low farm gate prices (the beneficiaries were perceived to be middle men); season fluctuation in prices attributed to seasonal changes in demand and supply; low supply of indigenous chickens due to low productivity; and disruptions of markets, high mortality of poultry in the marketing process due to inadequate of disease control in the indigenous chicken value chain.

- Markets

Like in many countries in the region, there are no poultry designated markets and therefore live poultry are sold in other goods and services markets constructed by central and local government in trading centres, large towns and cities. Key informants estimated that Kigali city has about 30-50 retailers and wholesalers operating in its various markets while other markets in other provinces could be linked to 150 to 200 primary collectors and traders.

- Price

In Kigali city, considered as the main terminal market, indigenous eggs retailed at RWF 120 and 25% less (RWF 80-100) in the rural areas. On the other hand, table eggs from exotic eggs retailed at RWF 80-100 in the Kigali and 33% less (RWF 60) in the rural areas. The analysis shows that indigenous prices are 40% higher than that of commercial exotic layers. The relatively higher prices could be attributed to consumer preferences in favour of indigenous chicken products and lower supply attributed to low productivity and alternate use of indigenous eggs where they are mostly used for hatching of chicks at the household level. The average price of live indigenous chicken is 2500RWF. According to GOR (2010b) the poultry impact ban mentioned above, saw, the consumer price of chicken at Kigali rise from 900RWF/kg to 2200RWF/kg. The report estimates that about 70-85% of the consumer price for chicken and eggs typically reflects the cost of feed. The report mentions of its intentions to prioritize the expansion of the domestic poultry industry and therefore requiring competitive feed prices to reduce the cost of chicken products and increasing consumption. This in turn will benefit cereals and legumes producers with additional markets.

- Consumers

Indigenous live bird meat and eggs are consumed in both rural and urban areas. Whereas producers are able to consume their own production, other regular consumer category could be said to belong to the middle and upper class attributed to the high prices of the indigenous poultry meat. In the rural areas, these are mainly traders and salaried people. In urban areas, consumers either consume at the food outlets or purchase live birds from live birds markets located within urban

areas. As presented earlier, indigenous chicken eggs find their way but in small consignments' to consumers.

The figure above summarise the indigenous chicken value chain.

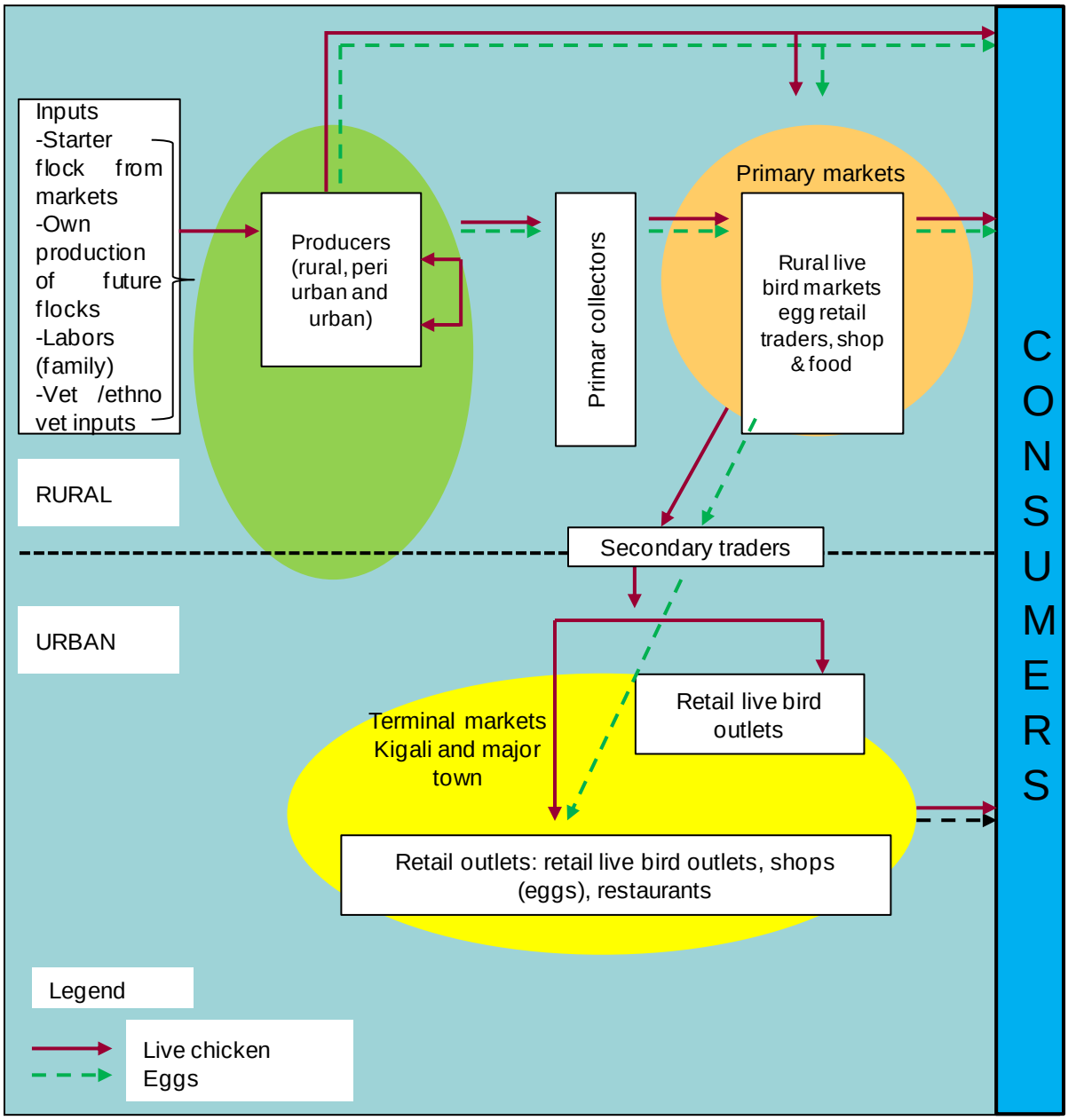


Figure 10: Indigenous chicken value chain in Rwanda (Source: FAO / Tabitha Kimani and Alex Nyarko 2011)

4.1.4.2 Value Chain for broilers

Majority of the broilers famers process the meat at the farm level and distribute directly to hotels and supermarkets without involvement of traders, making the broiler value chain quite simple. There are no professional processors or assemblers. The processing include on farm slaughter and packaging and cold preservation. Retailers of broiler meat can be represented by small scale butcheries.

Consumers purchase the meat from supermarkets and butcheries as well as in restaurants and hotels. The main consumers are in the middle and high class and mainly in urban areas. According to producer estimate, the cost of producing one kilogram of broiler meat was approximately 2000RWF while the broiler meat farm gate price was 2000RWF, 2300RWF, 2500RWF during low, medium and high demand season respectively one of the large scale producers cited that most producers produced 900 kg per day and 6 tonnes a week and low competition was reported. Mains lacks reported in broiler marketing were: low demand as consumers prefer local chicken, lack of modern equipments and low levels of biosecurity.

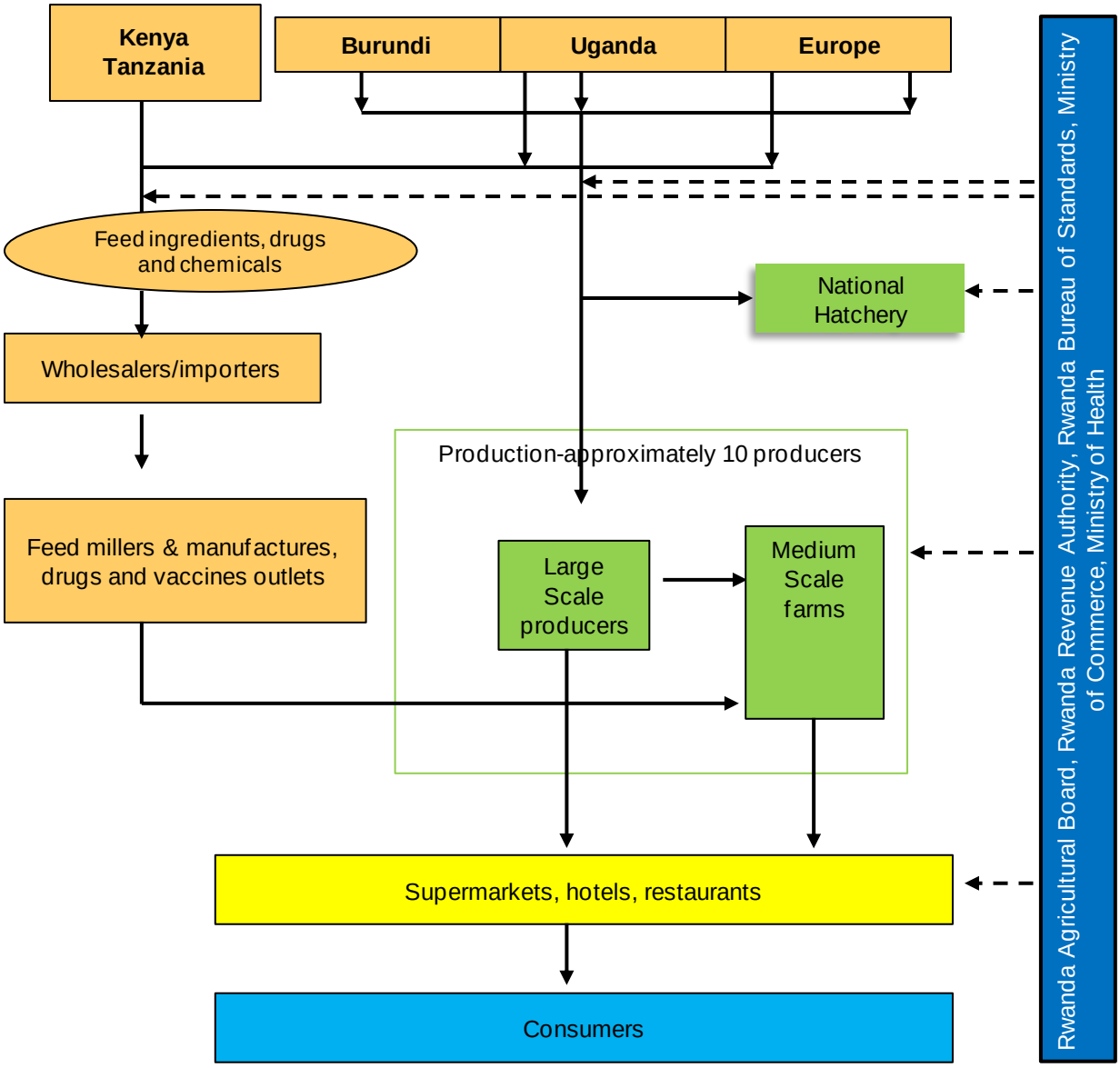


Figure 11: Broilers value chain in Rwanda (Source: FAO / Tabitha Kimani and Alex Nyarko 2011)

4.1.4.3 Value Chain for broilers

Table eggs sold within the country originates from two sources, internal production and imports from Uganda. More eggs are imported than produced. Key informants at the border points estimated that 900000 eggs are imported weekly. Wholesalers import the eggs and distribute to retailer shops, hotels and supermarkets throughout the country. Small scale and medium scale farmers sell locally produced

table eggs either directly to retail outlets (such as shops and supermarkets) or through primary traders who in turn sell to retail and wholesale outlets while large scale farmers delivered eggs directly to retailers and supermarkets. In rural areas, primary traders may sell to secondary traders who in turn transport eggs to Kigali city for retail and wholesale. Spent layers are sold through two main channels the live bird markets and directly into hotels and restaurants. The birds are slaughtered at the hotels and restaurants. A significant proportion of live spent layers are sold to neighbouring DRC through middle men. The average price for spent layers was RWF 1500-2000 per bird. Farm gate price of eggs is 55-60 RWF at while at the supermarkets the prices ranged from and 70 to 130 depending of demand and supply. Consumer's preferences yellow yolk large size and some demanded information on the origin of eggs.

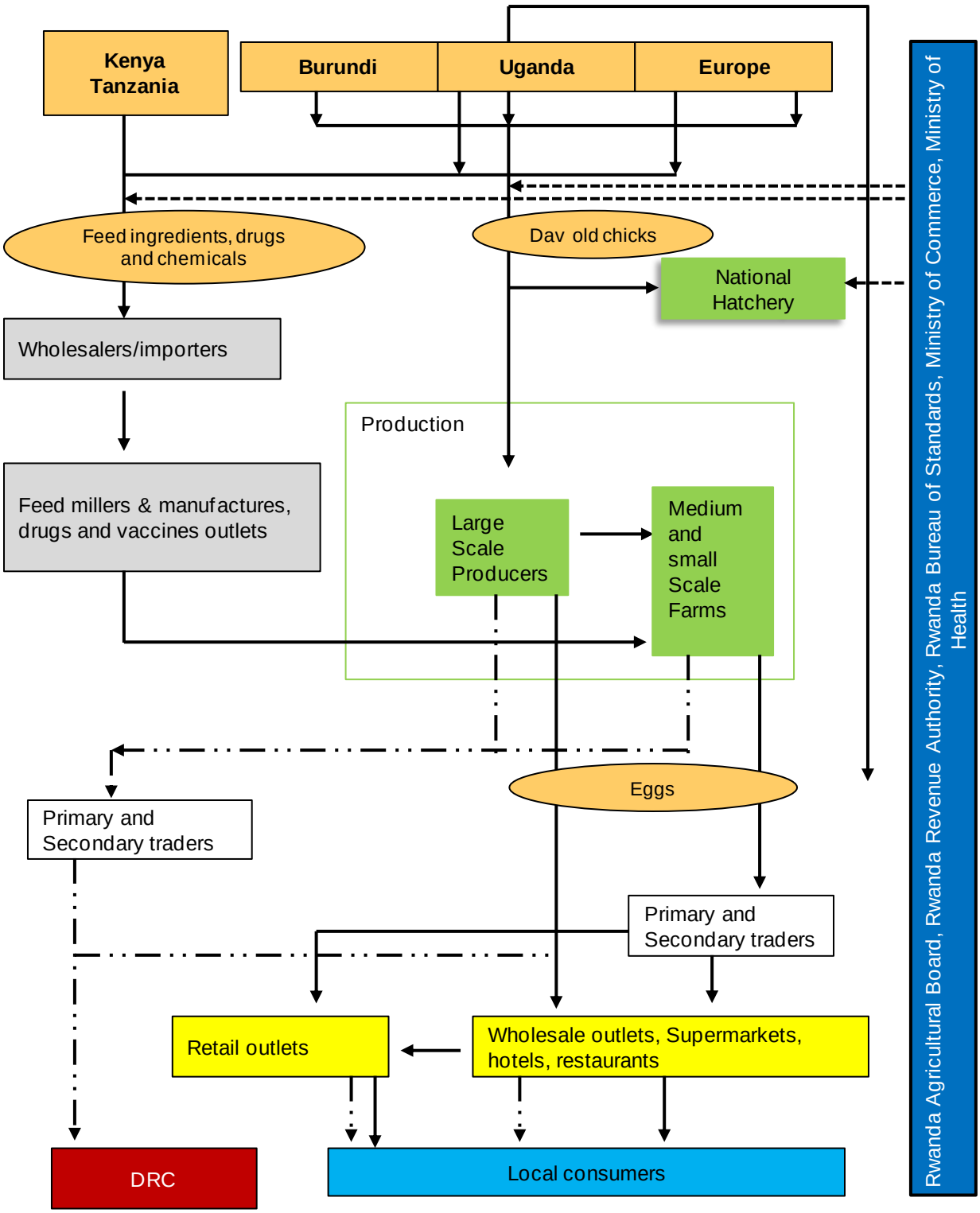


Figure 12: Layers value chain in Rwanda (Source: FAO / Tabitha Kimani and Alex Nyarko 2011)

4.1.5 Chicken meat and egg production as compared to bordering countries

4.1.5.1 Chicken meat

The meat per capita consumption for Rwandans is very low as compared to African average. Per capita consumption is in an increasing trend since 2004 but is still below 10 kg per year while the FAO rate for African countries is 32 Kg per year and will reach 16.2 kg in 2017.

Rwanda has common borders with Burundi, Congo, Uganda, Kenya and Tanzania. The chicken meat productions of Rwanda (2 500 tons) is far from those of Tanzania (47 000 tons), Uganda (38 000 tons), Kenya (24 500 tons) and twice lower than those of Burundi (6 800 tons) and Congo (5 700 tons). It is therefore hardly 2 pc of the global production.

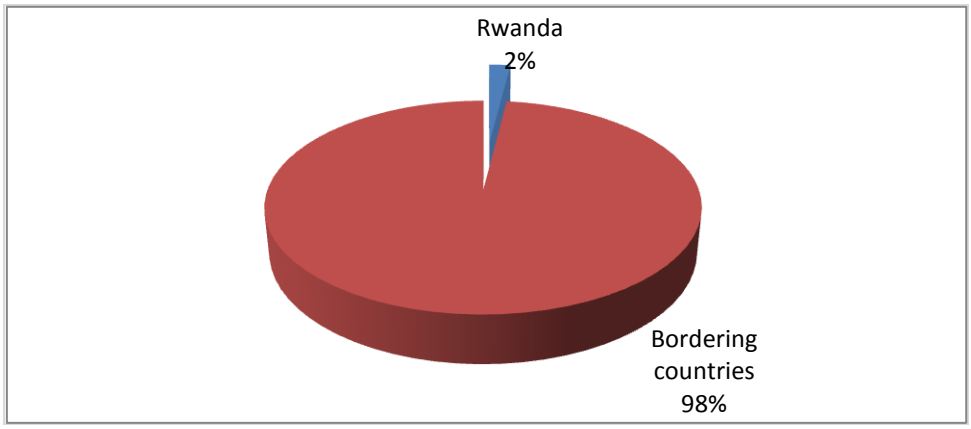


Figure 13: Chicken meat production in Rwanda and Bordering countries (Source: FAO, 2011)

At first glance it may seem presumptuous to consider making Rwanda an exporter of poultry meat; however, none of these countries is self-sufficient and they must proceed to imports to fill their domestic market.

It seems premature to competing countries such as Uganda, Tanzania and Kenya. Rwanda should focus on more accessible markets (Congo, Burundi, and DR Congo).

4.1.5.2 Egg

Egg production in Rwanda amounted for 2 900 tons in 2010.The relative egg production is the same as for meat, 2%, which is very low. Indeed, Rwanda is surrounded especially by 3 of the major egg producers in Africa: Kenya (80 600 tons), Tanzania (37 700 tons) and Uganda (23 100 tons).

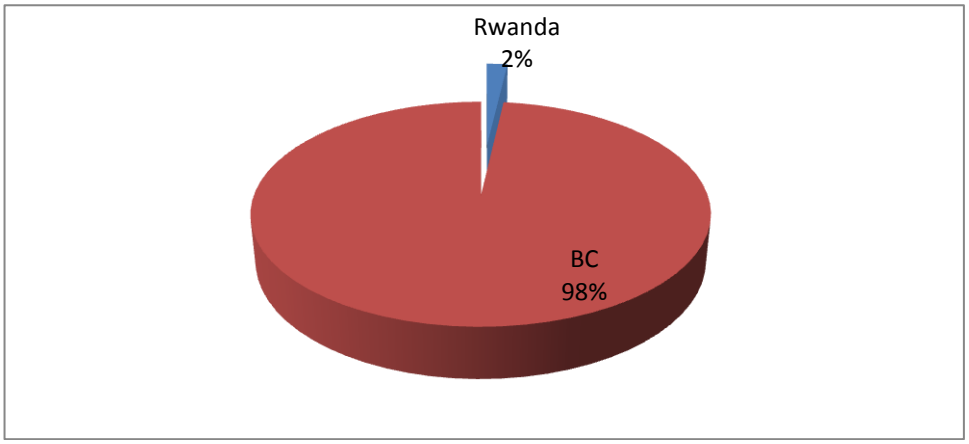


Figure 14: Egg production in Rwanda and Bordering countries (Source: FAO, 2011)

4.2 Strategic diagnosis: the SWOT of the poultry industry

4.2.1 Strengths

The tool SWOT is used to describe, analyze and diagnose the poultry industry in Rwanda.

4.2.1.1 The framework for livestock development

Various reform policies have given to Rwanda a framework favoring the development of livestock and meat industry.

- The decentralisation policy: adopted by the government of Rwanda to bring services close to populations, making «Umurenge» the focal unit for development;
- The new land policy: the aim is to secure land tenure to encourage investments in farming;
- The review of laws related to Animal Health: laws related to animal husbandry are currently reviewed by the government for adapting the context of livestock development and modernization;
- Strengthening of the veterinary profession: the veterinary profession in Rwanda through the Veterinary Association (ARMV) and the future Order of Veterinarians will play a significant role in veterinary service delivery and other aspects of animal husbandry.

4.2.1.2 Relevance of the poultry sector in the development policies

By transforming a fledgling poultry industry into a high-performance poultry industry (e.g. achieving the same standards as Kenya and Uganda), Rwanda will have a major asset in achieving MDG and meeting EDPRS targets.

4.2.1.3 Existence of foundations on which to build a modern poultry industry

- Involvement of the private sector: this is consistent with the public authorities to involve private sector in livestock development. Private investors are more likely to invest in poultry

than in other livestock activities. Unlike other countries where many farmers engage a fierce competition in a market more or less saturated, poultry farmers in Rwanda rather face difficulties to strengthen their capacities to meet the increasing demand.

- Presence of the RPIA, a professional organization including all stakeholders involved in the poultry industry such as farmers, importers & exporters, hatcheries, feed manufacturers, etc…
- Ideal weather for poultry rearing: in many African countries, the hot and dry climate undermines the poultry activity during a long period of the year. Rwanda is less subject to such constraints thanks to a relatively temperate climate. Moreover, the day/night natural cycle is ideal to egg production.

4.2.2 Weaknesses and constraints

The poultry industry is limited by several general constraints.

4.2.2.1 Village poultry in poor condition

Developing village poultry could be a key leverage in the generation of incomes for the poorest smallholders and the fight against poverty and malnutrition; the development of this sector is hindered by poor quality of the breeding stock (local breed ``Inyarwanda``), health conditions and housing constraints.

4.2.2.2 Availability of day old chicks

National supply of one-day chicks is virtually nonexistent. Almost all the chicks are imported, mostly from Uganda, Belgium and Netherlands. Chicks from Uganda are cheaper (500 rwf vs. 700; 850 vs. 950 for laying chicks) but the delivery times are long (2 to 3 months). Moreover, Rwanda faces competition from RDC (Goma) and South Sudan which have strong demand. This makes even more urgent the recovery of the National hatchery. The hatcheries available in Rwanda are listed below:

Table 7 : *Hatcheries in Rwanda (heads)*

Hatcheries	Parent stock	Incubation capacity
Rubilizi (national hatchery)	8 368	38 018
Kayonza	500	4 400
Bugesera	500	4 400
Nyirangarama	500	4 400
Gasabo	1 000	10 000
Musanze	300	4 400
Mageragere	2 000	10 000
Gisagara	800	10 000

Gasogi	1 500	10 000
Total	15 468	95 618

Source: Paul Heidloff of Williford, 2012

Incubation capacity is however misleading because most of these hatcheries operate only partially. This is confirmed by the following table, indicating the production of day-old chicks from the Rubilizi hatchery, which accounts for 28% of the national chick production capacity, and the subsequent imports to fill the gap.

Table 8 : *Day old chicks' production and imports in Rwanda (heads)*

Production and imports of chicks	2007	2008	2009	2010
Day-old chicks production	29 610	15 000	172 950	
Day-old chicks imports	56 500	106 500	506 120	1 087 390

Source: FAO, 2010; Dr Kanyandekwe, 2011

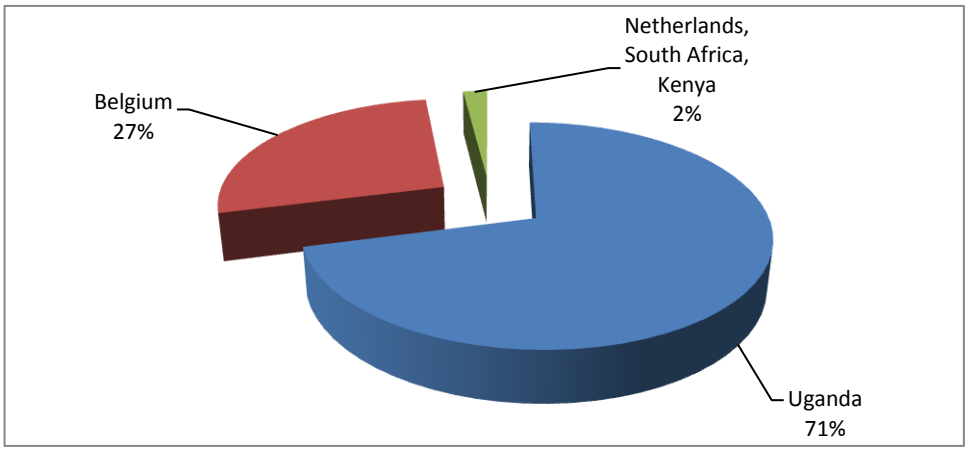


Figure 15 : *Origins of Day old chicks' imports in Rwanda (Source: RAB, 2010)*

4.2.2.3 Nutritional constraints

The emergence of high-performance poultry industry is closely linked to the implementation of poultry feed industry whose nonexistence compels farmers to produce the diets themselves. As a result, feed prices are higher due to the lack of economies of scale, not to mention quality problems. Thus, prices of diets range from 250 to 320 Rwf/kg. Given the production cycle which is about 70 days, the profit margin of farmers is significantly reduced.

Many ingredients used are relatively scarce in the domestic market and very expensive: soybean meal, cottonseed meal, sunflower meal, lysine, methionine, fishmeal, premixes… There is also an unpredictability of prices that fluctuate strongly over the year.

The problems related to the major ingredients are listed below:

Table 9 : *Difficulties related to the ingredients used in poultry feeds*

Ingredients	Constraints
Maize	• Competition with human consumption • High prices (110-280 rwf/kg) • Research on biofuel
Fish	• Imports from Uganda & Tanzania • High prices (580-1080 rwf/kg) • Inconsistent supply
Cottonseed meal	• Imports from Tanzania • High prices (280-360 rwf/kg)
Calcium	• Bad quality (65 rwf/kg) • Good quality (135 rwf/kg)
Soya	• Production covers 1/3 of the needs, the rest imported from DRC

4.2.2.4 Health constraints

According to reports, the health of the poultry flock is relatively good. However, the density of the poultry flock is expected to increase dramatically in the coming years, which will increase the risks of diseases. That led to the necessity to anticipate by implementing efficient poultry health management system.

4.2.2.5 Marketing constraints

- Disorganization of the poultry products market
- Unsuitability to market realities, resulting from the absence of cutting and processing facilities. The price of chicken meat is relatively high (about 2300 rwf/kg, whereas the whole chicken price ranges from 4000 to 6000 rwf). Sale in cuts could allow better accessibility for customers with low purchasing power;
- wrong ideas about chicken meat: Industrial chicken's meat allegedly less savory than the local breed's;
- Quality challenge: RBS should be put to use to develop quality standards for chicken meat.

4.2.2.6 Financial constraints

Modern poultry is a high-input activity and requires ideally balancing its budget before the start. Otherwise, any rupture of financing during the production phase will irrevocably compromise the profitability. Hence the necessity to credit lines available for farmers; however, financial institutions are cautious because considering the activity as too risky.

4.2.2.7 Institutional constraints

The poultry farmers expressed grievances that require government support for their implementation:

- Lack of development of the poultry industry;
- Lack of warehouses: that could allow the storage of ingredients and therefore better protection against prices fluctuations;
- Lack of synergy for stakeholders;
- Lack of protectionist policies, essential to protect the industry during its growth phase;
- Possibility of eliminating or reducing taxes on inputs, particularly feed ingredients.

Weaknesses to be removed to get the full potential of poultry sector can be summarized by the figure below:

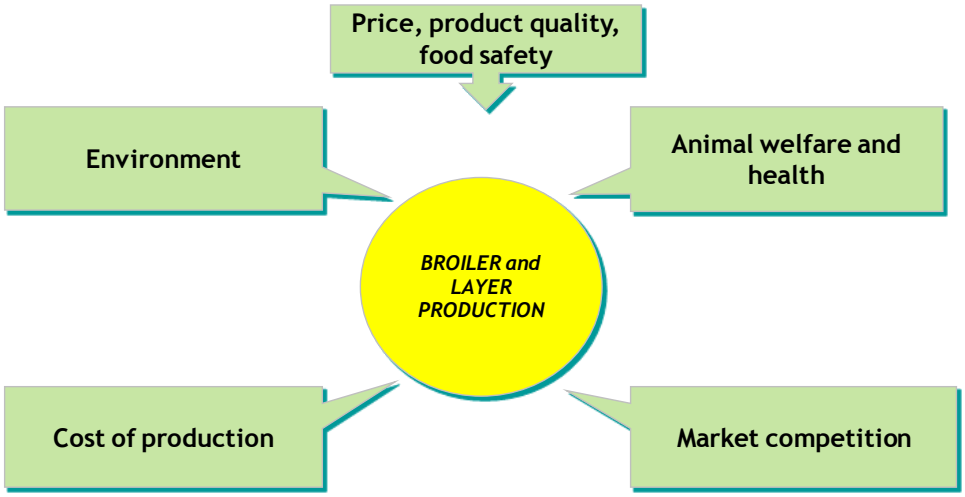


Figure 16: Field of conflict for broiler and layer production

4.2.3 Opportunities

Despite the constraints aforementioned, Rwanda has opportunities to launch a strong poultry industry if the threats that hinder its development are removed. The main opportunities are:

- A favorable political context for the emergence of a strong poultry industry; the public authorities emphasize the small animals for meat production;
- A growing tourism sector which request quality chicken and egg products;
- Commercial opportunities:
    - Enormous potential in the domestic market: just to reach the African average (4.9 kg eviscerated weight/year). Rwanda has to multiply its production by 20. Similarly, the production of eggs has to be multiplied by 14. The two eggs per child school program is also an opportunity for farmers;
    - Enormous potential in the regional market: many of the regional countries are deficient in chicken meat and egg and fill the gap by making imports.

4.2.4 Threats

Threats are cited below:

- Competition from Uganda: this applies especially to eggs. Indeed, the domestic market is flooded by products from Uganda that are also competitors to the access to regional market (Goma in DRC);
- Competition from Kenya: frozen broilers from Kenya are increasingly found in the market;
- Growing prices of ingredients used in poultry diets;
- Emergence of bird flu inside Rwanda or bordering countries.

5 CHALLENGES AND STRATEGIC OPTIONS FOR POULTRY INDUSTRY

5.1 Vision by 2017

The challenge of launching a poultry industry can be divided into five major objectives:

- Maintaining domestic market and increasing market share;
- Becoming globally competitive;
- Developing export opportunities and earning foreign change;
- Increasing food security;
- Increasing incomes of small-scale producers, emergence of major poultry business farmers.

These targets will be structured around the vision for the industry by 2017: « **Making the poultry industry a flagship of the Rwandan livestock** ».

Therefore, the industry will contribute significantly in achieving MDG and EDPRS targets: at the end of the 6-years recovery plan in 2017, the poultry industry should become a flagship of the Rwandan livestock.

This transformation should be mainly driven by a dynamic private sector with the advent of businessmen farmers and a gradual disengagement of the public sector.

Rwanda should take advantage of the export opportunities in neighboring countries such as Congo, Burundi and Democratic Republic of Congo to become a major exporter of chickens and eggs, thus increasing livestock contribution to the country GDP.

5.2 Strategic options

Two strategic priorities will achieve the vision which will increase the poultry industry from the primary step to a sustainable industry serving the social and economic development of Rwanda.

- Increasing poultry products supply
- Marketing

The objective of consumption per capita is to pass from 7.5 kg to the rate 15.07 kg in 2017 with consumption of chicken meat estimated around 9% of total meat consumption.

Table 10 : Trends of poultry populations within the period 2011-2017

Livestock	2011	2012	2013	2014	2015	2016	2017	Growth rate (2011-2017)
Poultry	3 890 274	4 790 274	5 790 274	6 890 274	7 990 274	9 090 274	10 677 269	174%

Source: Dr Papa Ndary NIANG, 2012

Table 11 : Trends of poultry meat and eggs production within the period 2012-2017 (tons)

Livestock	2011	2012	2013	2014	2015	2016	2017	Growth rate (2011-2017)
Poultry	5 252	6 467	7 817	9 302	10 787	12 272	14 414	190%
Eggs	4270	5257	6355	7562	8769	9977	11 718	174%

Source: Dr Papa Ndary NIANG, 2012

Two strategic axes will achieve the vision which will increase the poultry industry in Rwanda: Enhancement of the production and Marketing. The strategic axis will include 7 components.

- **Strategic axis n°1: Enhancing poultry meat and egg production**
  - Component n°1: Poultry nutrition
  - Component n°2: Supply of day-old chicks (Recovery and implementation of hatcheries)
  - Component n°3: Poultry Health and Biosecurity
  - Component n°4: Development of village poultry
  - Component n°5: Strengthening the institutional framework

- **Strategic axis n°2: Marketing**
  - Component n°1: Mastery of sanitary quality
  - Component n°2: Promotion of the poultry products

6 OPERATIONAL AND INVESTMENT PLAN

The overall budget to lift the poultry industry of Rwanda to the rank of a performing industry should be around **9,177,850,666 RWF**.

Table 12 *: Budget of investment plan for poultry industry strategy in Rwanda*

Strategic axis	Component MI	Amount in RWF
A1. Enhancing production	A1.C1. Poultry nutrition	2 700 000 000
	A1.C2. Supply of day-old chicks	1 187 850 666
	A1.C3. Poultry Health & biosecurity	1 100 000 000
	A1.C4.Development of village poultry	285 000 000
	A1.C5. Strengthening the institutional framework	2 075 000 000
	SUB TOTAL 1	**7 347 850 666**
A2. Marketing	A2.C1.Mastery of sanitary quality	425 000 000
	A2.C2.Promotion of the poultry products	1 235 000 000
	SUB TOTAL 2	**1 660 000 000**
Transversal action: Coaching for the implementation of the operational action plan	**SUB TOTAL 3**	**150 000 000**
TOTAL		**9 157 850 666**

Table 13 *: Contribution of key actors*

TIMEFRAME	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION	TOTAL
SHORT TERM	194 000 000	2 227 850 666	931 000 000	3 352 850 666
MEDIUM TERM	670 000 000	2 140 000 000	1 505 000 000	4 315 000 000
LONG TERM	245 000 000	645 000 000	600 000 000	1 490 000 000
TOTAL	1 109 000 000	5 012 850 666	3 036 000 000	9 157 850 666
Contribution	**12%**	**55%**	**33%**	**100%**

Source: Dr Papa Ndary NIANG, 2012

6.1 Overall approach

Strategies for «*Small animals industry*» «*Meat industry*» and «Poultry industry» have many cross-cutting issues. Indeed, strategies regarding animal health, policy and regulatory framework, promotion of livestock and livestock products, capacity building for stakeholders, access to regional and international market… cannot be dissociated. As a consequence, the need of consistency command the fusion of the 3 operational and investment plans while emphasizing the specificities of each study.

The budgets of the strategic axis are determined as follows:

- Taking into account of existing studies on costs of specific operation while adjusting these to the context of our studies: e.g. costs of production for Rubirizi hatchery in RAB documents and through meetings with poultry farmers; costs of capacity building for senior scientists in PSTA II document;
- Adjusting to the Rwandan context assessments of costs studies made by CABINET AFRIQUE EMERGENCE CONSEIL in other countries: e.g. costs of HACCP system implementation, costs of updating food security laboratories, feasibility studies for the implementation of slaughterhouses;
- Adjusting to the Rwandan context assessments of costs undertaken in neighboring countries: e.g. hatcheries (Tanzania, Malawi); or by organizations such as ILRI (assessment of feed resources).

6.2 Transversal actions

6.2.1 Management of the Approach & Harmonization of the Action Plans

Strategic approaches for «Meat industry», «Small animals industry» and «Poultry industry» were similar regarding the methodological approach and the strategic diagnosis.

Harmonization of the 3 Action Plans is a prerequisite for an overall success.

Two main actions should be included as cross-cutting actions:

- The communication plan of the strategy with stakeholders, authorities and development partners:
- Supporting the implementation of operational action plan through coaching (regular meetings, monitoring and evaluation, strategic dashboard). This item must be budgeted for 6 years around 25 Millions RWF per year (in total 150 Millions RWF).

6.2.2 Guarantee fund & Fund for financial support

The funds will aim at the development of a dynamic private sector. It will enable:

- the vitalization of Agri-business through actions such as loans guarantee programs, rural financial services and strengthening of stakeholder's organizations;
- the development of exports through actions such as subsidies for upgrading and labeling process and promotion of livestock products.

6.3 Strategic axis 1: Enhancing chicken meat and egg production

6.3.1 Component 1: Poultry nutrition

6.3.1.1 Strategic objectives

6.3.1.1.1 Assessment of feed resources available for poultry diets

- *Cereal grains*

The main cereal grain used in poultry diets in Rwanda is maize. Other grains used to a lesser extent include sorghum and wheat. Although the amounts and types of cereal grains included in poultry diets will depend largely on their current costs relative to their nutritive values, care must be taken to avoid making large changes to the cereal component of diets being fed to poultry as sudden changes can cause digestive upsets that may reduce productivity and predispose the birds to disease.

The quality of cereal grains will also depend on the seasonal and storage conditions. Poor growing or storage conditions can lead to grains with lowers than expected energy content or contamination with toxin-producing organisms such as fungi and ergots.

- *Vegetable protein sources*

The main vegetable protein sources used in Rwandan poultry diets are meal by-products resulting from commercial vegetable oil production, such as cottonseed and soybean meals. Many oilseeds and legumes contain chemicals that can have detrimental effects when fed to poultry. These chemicals are called antinutritive factors. Some of these antinutritive factors can be destroyed by heat and so are not problems in heat-treated meals. New cultivars of some oilseeds and legumes have been developed that are naturally low in antinutritive factors and so higher levels of the unprocessed grains can be included in poultry diets without ill-effect.

- *Animal protein sources*

The main animal protein sources used in poultry diets are meat meal, meat and bone meal, fish meal, poultry by-product meal, blood meal and feather meal: In Rwanda almost the totality of animal protein source is fish meal.

- *Sources of minerals*

In Rwanda, minerals used in poultry diets derived from crushed shells of artisanal manner, which often leads to quality problems.

The following table gives an indication of the nutrient composition of the ingredients commonly used in poultry diets in Rwanda.

Table 14 *: Nutrient composition of the ingredients commonly used in poultry diets in Rwanda*

Nutrient Composition of Cereal Grains					
Ingredient	**Crude protein (%)**	**Metabolizable energy (kcal/kg)**	**Calcium (%)**	**Available phosphorous (%)**	**Lysine (%)**
Wheat	13.0	3153	0.05	0.20	0.5
Sorghum	9.0	3263	0.02	0.15	0.3
Corn	8.69	3439	0.03	0.32	0.5
Nutrient Composition of vegetable protein sources					
Cottonseed meal	41.0	2350	0.15	0.48	1.7
Soybean meal	48.0	2557	0.20	0.37	3.2
Nutrient Composition of animal protein sources					
Fish meal	60.0	2720	6.50	3.50	5.3

6.3.1.1.2 Technical assistance to feed formulation

Feed formulation is the process of quantifying the amounts of feed ingredients that need to be put together, to form a single uniform mixture (diet) for poultry that supplies all of their nutrient requirements. It is one of the central operations of the poultry industry, in view of its role in ensuring good nutrition. Feed costs account for more than 70% of the total production costs for most types of poultry, so it is important that returns are maximised through use of adequate diets.

Feed formulation is a central operation in poultry production, ensuring that feed ingredients are economically used for optimum growth of chickens. It requires a good knowledge of poultry and feed ingredients. Most large-scale poultry farmers depend on commercial feed mills for their feeds, to obviate the need to do their own formulations or feed preparation. It is therefore essential that formulations are accurate, to ensure a large number of flocks are not adversely affected.

Feed formulation is both a science and an art, requiring knowledge of feed and poultry, and some patience and innovation when using formulae. Typical formulations indicate the amounts of each ingredient that should be included in the diet, and then provide the concentration of nutrients (composition) in the diet. The nutrient composition of the diet will indicate the adequacy of the diet for the particular class of poultry for which it is prepared (e.g. egg layers, meat chickens or breeders). It is common to show the energy and protein contents of the diet but comprehensive information on concentrations of mineral elements and amino acids may also be provided. Since lysine is a key amino acid for poultry, the concentrations of the other amino acids may be related to it. Because some nutrients interfere with the utilisation of other nutrients, relationships between nutrients, particularly amino acids, also show if each of the nutrients will be used efficiently.

Although it does not appear to be a part of the feed formulation process, the first step in feed formulation is evaluation of ingredients. The requirements of the chickens for nutrients such as protein, mineral elements (e.g. calcium), and energy need to be identified. These requirements vary with age, type of chickens (layer or meat type), level of production, etc. It is also important to obtain and compare the prices of feed ingredients, in order to reduce the overall cost of the diet.

With this knowledge, mathematical formulae are used to derive the amounts of each ingredient that need to be included in the mixture, i.e. the diet. When using only a few ingredients, the formulae are simple, but a few ingredients are rarely able to supply all the nutrients that will meet the requirements of the bird, so several ingredients are used, requiring complex formulae. Some of these formulae have been built into computer programs, which enable the rapid processing of values that should be included in the formulation. Computer programs also make it easy to check if nutrient requirements are met.

It is important, however, to evaluate the diet in the laboratory or feed it to a small group of chickens to confirm the adequacy of the diet. This may not be necessary if the actual composition of the ingredients used is known and the actual nutrient composition can therefore be obtained. Although the average composition of many common ingredients is known, ingredients tend to vary between batches (e.g. in drought years cereals can be lower in quality).

Many farmers prefer to manufacture their own poultry feed in order to reduce feed costs. They often get the opposite effect, since the poor quality of diets fformulated (due to lack of technical skills) generate extra costs associated with low productivity of broilers and layers. A permanent unit/desk for technical assistance in poultry feed formulation could assist farmers on this. The members of this desk (veterinarians and/or zoo technicians with enhanced technical skills) should have a dual purpose:

- Technical assistance for the farmers who make their own formulas
- Quality audit and compliance of the commercial feeds

Finally, a properly equipped laboratory under the supervision of the desk aforementioned is required to support the objectives.

6.3.1.1.3 Implementation of animal feed manufacture

Animal feed manufacture is the missing link in the poultry industry. Animal feed manufacturing plays a vital role in the overall food production industry. It’s a very active business and its players are always in dynamic interaction. Feed manufacturing business is a capital-intensive venture.

A lot of money is needed to buy manufacturing machinery (bagging equipment, boilers, computer process control, conveyors, mixers, dryers, scales, extruder, and grinder), computer technology, and vehicles for transporting raw materials and finished products. Another consideration in this business is the huge inventory investment. Feed manufacturers usually take advantage of fluctuations in feed ingredient prices by buying in bulk when prices are low; or by contracting for supplies months ahead.

Animal feed should meet nutritional requirements in terms of energy, protein, fiber and vitamins. And so, to meet requirements while ensuring that the business is profitable, animal feed producers spend substantial amount of resources toward finding out a feed formulation that meets nutritional requirements at the least possible cost. This process needs computers with software for running linear program to calculate the desired diet formulation. It also needs the expertise of animal nutritionists.

The amount of investment required is beyond the reach of most businessmen. The implementation of animal feed manufacture could ideally be achieved in a Public Private partnership (PPP).

6.3.1.2 Evaluation indicators

These indicators will enable the monitoring of the rates of achievements of the strategic objectives:

- Quantification of locally produced ingredients utilizable for poultry feed
- Poultry nutrition specialists in MINAGRI/RAB
- Feed manufactures achievement before 2014
- Warehouses building before 2014

6.3.1.3 Operational and Invest plan

The operational and invest plan includes the stakeholders involved and the timeframe for each strategic objective.

Table 15*: Operational and Investment plan for Poultry Nutrition*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	PRIORITY	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Implement 2 Animal feed manufactures (PPP)	2 000	MINAGRI/RAB, Private Sector							SHORT TERM	-	1 500	500
Upgrading quality control laboratory	400	MINAGRI/RAB, RBS							SHORT TERM	100	-	300
Establish quality standards for poultry feed	100	MINAGRI/RAB, RBS, Private sector							MEDIUM TERM	15	75	10
Research – development linkages to formulate poultry diets matched with the feed resources locally available	200	MINAGRI/RAB, NUR, UPU, ISAE, other Research institutions							MEDIUM TERM	50	50	100

Source: Dr Papa Ndary NIANG, 2012

6.3.2 Component 2: Supply of day-old chicks

6.3.2.1 Strategic objectives

6.3.2.1.1 Mastery of the rearing of Parent Stock

The management of the parent stock has become a more important part of the production process because of the genetic changes in the rearing material. Wrong management is resulting in less good results, which can be at the cost of the technical as well as the financial results of the quality of the day old chickens at the broiler and layer farms.

The rearing of parent stock is an activity requiring great technical mastery and respect for stringent biosecurity standards. To achieve the best possible outcome, the best possible start must be provided to both the male and the female parent. Fulfilling all of their requirements during the rearing period will prepare them for sexual maturity.

The production of hatching eggs requires management practices that are also required for the production of commercial table eggs. But there is an important difference: the eggs must also have been fertilized and hatch well.

Field surveys in hatcheries, including Rubilizi hatchery indicated that management standards for the breeding stock are not met. The result is very low fertility rate (less than 65%) and hatching rate (less than 40%).

Management standards of parent stock must be strictly observed. Otherwise, the maintenance of Parent Stock would not be economically viable and should be replaced by the import of hatching eggs.

The meeting of management requirements should improve the weaknesses of the parent stock breeding: health, fertility, hatchability. The pre requisites are:

6.3.2.1.1.1 Farm isolation

Usually breeding birds are subject to some kind of disease-free programme: *Pullorum*; *Mycoplasma gallisepticum* (Mg); *Mycoplasma synoviae* (Ms). The isolation of the breeding flock must be complete in order to prevent the entrance of disease from outside: use separate personnel and the persons involved must shower and put on clean clothing before entering the premises.

The permanent breeding quarters are also used for the brooding and growing period of the breeders. There is no transfer from one house to another; this eliminates stress due to transfer and reduces the risk of an outbreak of Mg and Ms.

6.3.2.1.1.2 Conditions in the breeder house

A concrete floor is required, because such a floor is more sanitary and easier to clean. Breeding birds are given more floor space per bird than commercial egg laying hens; as indication (adult birds):

Type of bird (male included)	litter		Wire/slats and litter (1/3-2/3)	
		Birds/m^2		Birds/m^2
Leghorn type		6		7
Medium size		6		6
Meat type		4.5		5

All-wire floors are not used in breeder houses because hens do not like to be mated on wire.

- Feeding space (indicative):

	Leghorn	Medium	Meat-type
Straight feeders	10 cm/bird	12 cm/bird	15 cm/bird
Round feeders	5 cm/bird	6 cm/bird	7.5 cm/bird

- Drinking space:

	Leghorn	Medium	Meat-type
Straight drinkers	2.5 cm/bird	3 cm/bird	4 cm/bird
Round drinkers	1.5 cm/bird	2 cm/bird	2.5 cm/bird

- Nests: provide one nest for every four hens; meat-type birds need larger nests than smaller birds.
- Light: in environmentally controlled houses a lighting schedule should be kept, for maximum hatching egg production. In other cases a lighting schedule may be kept adapted to the natural length of the day.

6.3.2.1.1.3 What should have been done before breeding starts?

At the end of the growing period of the breeders the following matters should have received attention already. When the production of hatching eggs has started, it is too late for these measures:

- Proper vaccination: Vaccination schedules for breeder birds are different from commercial egg laying birds. Blood titers should have been checked
- Debeaking; female breeders should have been debeaked.
- 6-8 week selection; in meat-type birds the smaller males and females are removed at this stage
- mature selection; just prior to the onset of egg production, males and females of poor quality are removed from the flock
- if sexing errors are discovered, remove the birds concerned immediately, at any time
- internal parasites; if worms were present during the growing period, an effective eradication programme should have been carried out - allowing the birds to start their breeding period free of worms
- Mg, Ms and Pullorum negative; just before or immediately after egg production starts, the cockerels and the hens should be blood tested
- Correct mature body weight. The feeding programme during the growing period should have been such that it produced a specified body weight at sexual maturity

Again, the above should have been done or accomplished during the growing period.

6.3.2.1.1.4 The importance of correct body weight

Breeder birds should have the right body weight when they reach sexual maturity; therefore they should be weighed, at least every two weeks. In particular, medium size and meat-type birds have a tendency to develop too much body fat. For these types the body weight should also be controlled during the period of egg production. Good body fleshing but without excessive fat is desirable for the following reasons:

- onset of egg production is delayed
- first eggs are larger
- egg production during the laying cycle is increased
- more hatching eggs are produced (because the eggs will be of a larger size)
- laying house mortality is reduced
- feed cost of growing pullet to sexual maturity is lowered

- feed cost of producing a hatching egg is reduced
- fertility of the hatching egg is increased
- hatchability of the hatching egg is improved

If the breeder birds are fed to appetite during their growing period, they may be too heavy at sexual maturity and may not produce the possible maximum number of eggs during the laying cycle. Feed allocations should be made with the aim of obtaining the recommended body weight for the particular type of bird concerned. There are no set rules: follow the instructions of the breeder of the birds.

To check the body weight, females should be weighed once every two to four weeks during the laying cycle. Weigh a representative sample of the hens in each pen. Weigh a sample of the males too.

6.3.2.1.1.5 Measures to improve fertility

About 4 weeks before reaching sexual maturity (i.e. at about 18 weeks of age), the males should be placed with the females. It should be done late in the afternoon, as this will reduce fighting; fighting will occur for about half an hour in this case, until sunset (the next morning it is over). Too many males in the breeding pen reduce fertility; not enough males has the same effect. The ratio is about 1:10; slight deviations may be useful depending on the breeds involved, as is shown in the following table (indicative only).

A few extra males should be placed in the pens at the time when the cockerels are introduced to the hens, to allow for some early culling and mortality from fighting. But remove them as soon as the flock seems to have come to rest.

Males	females	product	Males per females
White leghorn	White leghorn	White leghorn	8
Medium size	Medium size	Medium size	9
Meat-type	Meat-type	Meat-type	11
White leghorn	White leghorn	Hybrid layer	8
Medium size	Medium size	Hybrid layer	9
Meat-type	Meat-type	Broiler	11

Males mate between 20-80 times a day. During hot weather cocks have a reduced sex drive, which may result in no significant fertilization of eggs at all. Most matings take place in the cooler part of the day (early morning).

Fertile eggs will be produced for days after the males are removed from the flock; but if males are removed and new males added to the flock the same day, the fertile eggs produced after three days will be the result of matings by the new males.

Excessive body weight of the male at maturity must be avoided. Any inferior looking male should immediately be removed (catch by both legs).

Proper equipment must be used for the males. Often feeders and drinkers are inadequate for cocks. Place special feeders for cocks if their body weight is too low. They must be placed higher so that only the cocks can reach them.

- The timid male. In males as in females there is a certain social order. A timid male may not receive enough feed. Enough feeding space should be given. When cocks have sore feet they will not mate. Treatment must be immediate.
- Males not mating. On a partly litter floor, males will show a tendency to remain on the wire/slats, as a sort of 'roosting' place. Hens prefer to be mated on the littered part. Strewing a little grain in the litter will cause the males to come down.

Age of breeders: cockerels (young males) give better results than older cocks. It is not advisable to use males above two years of age.

Light during the egg production period stimulates the production of eggs and also increases the quantity and the quality of the semen of the males. A specified lighting schedule is to be applied.

6.3.2.1.1.6 Hatching egg production

The only purpose of keeping breeding birds is to produce an abundance of hatching eggs that will give a high percentage of quality chicks. The following management practices are important for the production of hatching eggs:

- Nesting material

Hatching eggs are valuable and egg breakage is costly. Therefore abundant nesting material should always be available. It should have the following properties: absorbent, durable, coarse so that it will not easily be blown from the nest, dust free, good cushioning quality and inexpensive.

Useful nesting materials are wood shavings, groundnut hulls, rice husks, chopped corn cobs, straw and hay.

- Floor eggs

The breeder hens should be trained to use the nest rather than the floor on which a high percentage of the eggs laid will be broken. Floor eggs are also less suitable for hatching. To induce hens to lay their eggs in the nests:

  - nests placed in the pen before the birds start laying
  - nesting material put in the nests at the time the nests are placed; keep the nesting material clean before egg production starts

- if roll-away nests are used, put nesting material in them before and during early egg production;
- hens refuse wire-floored nests: provide adequate nesting material; if the material has been blown out of the nests, or if it is worn-out, with bare surfaces showing, the hens are not likely to lay eggs in the nests block off corners of the pen where hens congregate and are likely to lay eggs on the floor; do this before egg production starts
- make sure that there are enough nests; if a hen cannot find a nest in which to lay an egg, she will be forced to find a 'nest' on the floor
- disperse broody hens as they take up nesting space, forcing other hens to lay eggs on the floor

- Collecting hatching eggs

Hatching eggs should be collected from the nests at least 4 times per day; in extreme temperatures 5-6 times per day. Frequent collection decreases breakage and helps to maintain the hatching potential. It is important to collect the eggs that are laid late in the afternoon on the same day. Hatching eggs left in the nest overnight will lose some of their hatching qualities.

Suggested time schedule for the collection of hatching eggs, under a natural daylight programme:

- 3 hours after sunrise (e.g. 09.00 hrs)
- 4 hours after sunrise (e.g. 10.00 hrs)
- 5 hours after sunrise (e.g. 11.00 hrs)
- 6 hours after sunrise (e.g. 12.00 hrs)
- 7 hours after sunrise (e.g. 13.00 hrs)
- 11 hours after sunrise (e.g. 17.00 hrs)

Close the nests at night and open them again early in the morning, before egg production starts. Do not allow hens to sit in the nests overnight and remove any hen found in the nests, to prevent broodiness.

- Egg containers

- use only plastic egg flats (key-trays). never use a bucket or basket because eggs piled on top of each other will break and cannot cool down place the eggs with the narrow end down
- when collecting eggs, separate the extra large/double yolk/misformed & cracked eggs from the normal ones
- do not carry more than 2 egg flats on top of each other unless a special carrying device is used
- disinfect and fumigate egg flats after use

The hatching eggs should be fumigated as soon as possible after collection.

Storage time should be as short as possible. At 2-3 days after laying hatchability decreases.

For short periods (up to 4 days) hatching eggs should be stored at 18-20 °C. For longer storage periods, the eggs should be stored at 18 to 14 °C; longer than ten days at 12 °C. Try to maintain a relative humidity of 80% or more.

- Selection of hatching eggs

Hatching eggs should be first-class, fertilized eggs. There is no way yet of checking the fertility before incubation, but the practices outlined below will help to eliminate possible failures.

Guidelines:

- do not include dirty floor eggs
- only first class eggs should be used; all eggs with obvious abnormalities should be rejected
- misformed eggs do not hatch well
- broken or cracked eggs are useless because they dry out inside the incubator
- small eggs usually give weak chicks
- long eggs are mostly ‘double yolks’ which will never hatch
- Abnormally coloured eggs are usually the result of a genetic defect.

There are specific egg-weights for each type of chicken according to their production season, but in general a hatching egg should weigh between 52 and 70 g.

Handle hatching eggs carefully because they are costly!

6.3.2.1.1.7 Vaccination

Breeding birds should produce parental immunity in chicks. To produce a constant degree of parental immunity it is necessary to revaccinate the breeder females for Newcastle Disease and Infectious Bronchitis at intervals of 12 weeks during the laying period.

6.3.2.1.1.8 Recycling of the breeder flock

Breeder flocks used for the production of hatching eggs are often force-moulted and 'recycled'. The reasons for doing this are:

- to supplement normal hatching egg production
- to compensate for high mortality in the growers; if there is excessive mortality in the growing flock that is going to replace the present flock, the latter may assist a second time in the production of hatching eggs
- an unexpected heavy demand for chicks (the demand for day-old chicks is sometimes difficult to predict)
- for single-line breeders, recycling the flock (or part of the flock) is the most reliable method of improving the breed

Force-moulting can be achieved by one (or a combination) of the following methods:

- Water withdrawal for one or two days, after which water supply is restored and then withdrawn for another two days. Not to be practised during hot weather.
- Feed withdrawal for several days, or feeding an unbalanced ration (feed grains only).
- Light withdrawal in environmentally controlled houses, well below 11-12 hours per day. Any one (or a combination) of these methods will create stress in the birds, causing them to drop their feathers and lose weight. Hopefully not many of them will die. After two days of depriving the birds of water and/or feed, a return is made to a skip-a-day programme (one day feed, the other day water) which is continued for one week.

After this a normal, controlled (restricted) feeding programme. After 60 days the light may be stepped up to 14-16 hours per day. Egg laying will resume.

Force-moulting a flock and recycling is only worthwhile if the quality of the flock is excellent. Only birds having desirable characteristics should be used. In most cases it is advisable to add new males to the breeder flock because they are more fertile.

Note: it should be kept in mind that force-moulting is a difficult technique and it should not be taken lightly.

In a tropical climate moulting can quite easily take place accidentally too. For instance, because of a heat stroke, watering failure or a sudden change in feed quality. Accidental moulting always means a very serious economic loss.

The points aforementioned give an idea of the high technical standard being required to manage efficiently the rearing of parental stock. This is out of the reach of most mini-hatcheries in Rwanda.

6.3.2.1.2 Recovery of the National hatchery and implementation of decentralized mini-hatcheries

The first major decision should be the privatization of the Rubilizi hatchery, for at least four reasons:

- Consistency with the decision of public authorities to make the private sector the lever for the development of livestock in Rwanda
- Responsiveness that requires daily management of a hatchery doesn't fit well with the administrative burden
- Although not having the hatchery's cost accounting, we can say without doubt that the current management is in deficit; it couldn't be otherwise with such low fertility and hatching rates. Thus, the state budget subsidizes an activity that could be profitable in the hands of private operators.
- The immense attraction of potential investors for the privatization of the national hatchery: the public authorities should have no difficulty in passing the baton to private investors, as their interest is evident. This should be done in Public Private Partnership, the government retaining ownership of premises and facilities.

Given the complexity of the basic requirements for the management of parent stocks, partnership should be forged between the recovered National Hatchery and mini-hatcheries: the latter would thus get rid of the worries associated with maintaining parent stocks, as well as the import of hatching eggs. The key implementation areas should be the Kigali region and the Northern Province, where the poultry is more developed. The partnership model is illustrated by the figure below:

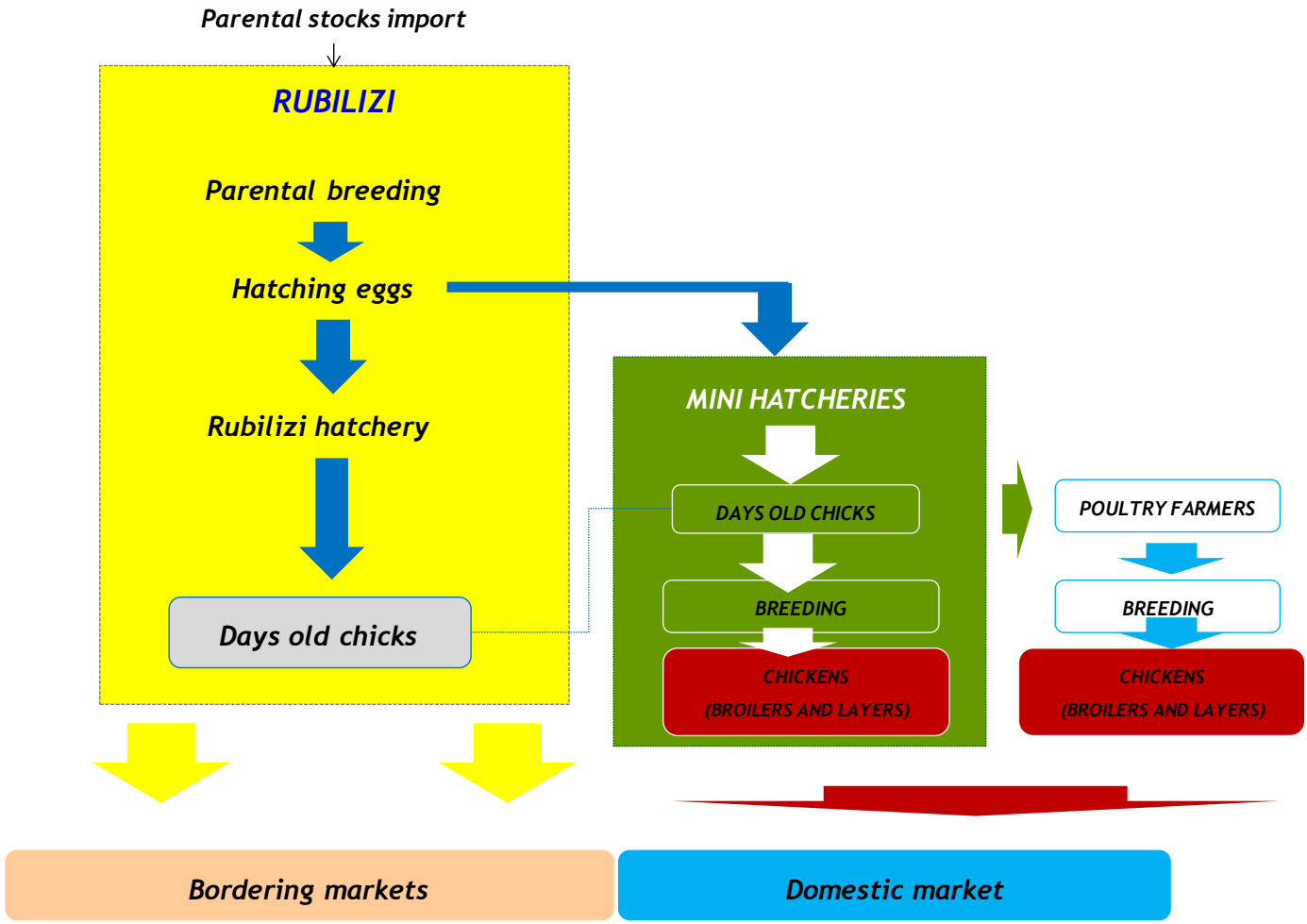


Figure 17: Rubilizi Hatchery, a major supplier of day old chicks in Rwanda (case of privatization)

Rubilizi will give to mini hatcheries 30 000 fertilized eggs per month (50% Layers, 50% Broilers).

6.3.2.2 Evaluation indicators

These indicators will enable the monitoring of the rates of achievements of the strategic objectives:

- Trained specialists for breeding stock management
- Guidelines for the management of Parental stock
- Privatization of the Rubilizi hatchery
- 10 operational mini-hatcheries in Rwanda

6.3.2.3 Operational and invest plan

The operational and invest plan includes the stakeholders involved and the timeframe for each strategic objective.

Table 16*: Operational and Investment plan for Supply of day-old chicks*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	PRIORITY	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Recovery of the national hatchery	687.851	MINAGRI/RAB, RPIA, RDB							SHORT TERM	-	687.851	-
Support the implementation and upgrade of decentralized mini-hatcheries	500	MINAGRI/RAB, RPIA, RDB							MEDIUM TERM	50	400	50

Source: Dr Papa Ndary NIANG, 2012

6.3.3 Component 3: Poultry health and biosecurity

6.3.3.1 Strategic objectives

The overall poultry health strategic objectives are the same as those developed in the document "strategy and investment plan for the small animal industry". The purpose of this chapter is to underline the specific biosecurity measures to the poultry industry.

The word *security* is defined as "freedom from danger". So, *biosecurity* can be defined as "freedom from danger represented by biological agents". The biological agents that present "danger" to the poultry industry are, of course, those microscopic organisms that include viruses, bacteria, and parasites. The viruses, bacteria, and parasites that we are concerned with are pathogenic organisms that require a host in which to grow and reproduce, particularly those that require the avian species as a host. The Rwandan Poultry Biosecurity Program should be a series of protocols that are designed to reduce the "danger" of biological agents to poultry flocks.

The biosecurity program should consist of 4 mandatory standards:

- Farms access standards,
- barns access standards,
- flock health management standards
- and farms management standards.

6.3.3.1.1 Farms access standards

Farm access represents the first critical control point for entry of an infectious disease organism into the farm. It is essential, therefore, to have a perimeter that discourages or prevents unauthorized entry by people and their equipment, while allowing authorized entry when certain conditions have been met. All visitors, including casual and professional, and equipment entering the area behind the access control, referred to as the Controlled Access Zone, should be subjected to conditions and procedures that will minimize the chance of a disease infecting the flock.

- *Mandatory standard n°1: Secure barrier*

A secure barrier that restricts vehicle entry must be present at all primary and secondary accesses to the Controlled Access Zone. Secure barriers are the first line of defence in minimizing the

transmission of infectious diseases both to and from the farm operation. The barrier should be a fixed gate, chain or equivalent that restricts access.

- *Mandatory standard n°2: Biosecurity signage*

Biosecurity signage must be clearly displayed at all primary and secondary accesses. The security of the Controlled Access Zone is strengthened by effective signage (e.g. ``No entry``; ``biosecurity in effect``, etc…).

- *Mandatory standard n°3: Primary access surface*

All primary accesses to the Controlled Access Zone must be constructed of hard surface or gravel that prevents any persistent accumulation of pooled water. Standing water can harbour infectious diseases that may be transported to or from the premises by vehicular traffic and people. Such protected pathogens also serve as a reservoir that may re-infect the farm after cleaning and disinfection.

- *Mandatory standard n°4: Cleaning and decontamination site*

All primary accesses to the Controlled Access Zone must have an approved Cleaning and decontamination site for vehicles and personnel. Visible accumulations of organic matter can harbour and protect infectious organisms that can then be transported onto or off of the premises. As with water-protected organisms, this organic debris can serve as a reservoir that may re-infect the farm. These accumulations must be removed to reduce the risk of disease transmission. In the event of an infectious disease outbreak, disinfection may be required to further reduce the opportunity for disease to spread to or from the premises.

- *Mandatory standard n°5: Cleaning the controlled access zone*

The Controlled Access Zone must be maintained clean and free of organic debris at all times. Visible accumulations of organic matter can harbour and allow transport of infectious organisms onto or off of the premises and can serve as a reservoir for reinfection.

6.3.3.1.2 Barn access standards

The barn entrance is the last line of defense in preventing entry or exit of disease-causing organisms. It is imperative, therefore, that only those that are absolutely necessary are allowed access to the barn. Because of the importance of limiting exposure of the flock to outside contacts, this area is referred to as the Restricted Access Zone.

- *Mandatory standard n°6: Lock barn entrance*

All poultry barn entrances shall remain locked at all times that the barn is unsupervised by farm personnel. Barn entrances are high disease transmission risk areas and are the last line of defence in preventing disease transmission. It is therefore necessary to prevent inappropriate access.

- *Mandatory standard n°7: Signage*

Approved restricted access signs shall be posted at all barn entrances.

- *Mandatory standard n°8: Anteroom*

All poultry barns must have an anteroom at all primary entrances that allow personnel to comply with the farm biosecurity procedures during entry and exit. The anteroom provides a unique opportunity to reduce the risk of transmission by minimizing the movement of contaminants into or out of the barn. A workable anteroom provides enough space to have a separating line or demarcation between the door entering the building and the door entering the bird holding area. Space within the anteroom should be available to hang outside outerwear on the outside of the barrier and barn coveralls and head cover on the inside of the barrier.

- *Mandatory standard n°9: Anteroom maintenance*

Barn entryways and anterooms must be maintained clean and free of debris at all times. Visible accumulations of organic matter may harbour infectious organisms and increase the risk of the

transmission of these organisms either into or out of the barn. Accumulations of organic matter must be removed to reduce the risk of disease transmission. Anterooms must be regularly cleaned and disinfected.

6.3.3.1.3 Flock health management standards

The farmer will be the first to see signs of illness that may be a serious infectious disease in the flock. If a Foreign Animal Disease, such as Avian Influenza or Exotic Newcastle Disease, were to break through the farm's biosecurity protocols, then that farm becomes a serious risk to the rest of the industry. It is the early recognition of that first case that will be critical in containing and eliminating the disease quickly.

Farm mortality records will alert the producer to a potential problem, which should trigger the appropriate responses, the first of which will be to find the cause of the problem. The farmer should not try to diagnose the condition but instead should consult with his or her veterinarian or the diagnostic laboratory. If an infectious disease is suspected, then the next response will be self-quarantine.

- *Mandatory standard n°10: Flock health records*

Individual flock health records must be maintained. In the event of a disease outbreak the individual flock health records will provide invaluable information to assist in containing the outbreak. Records must include a count of mortalities collected at least once each day. Production records must be kept, as well as veterinary and diagnostic reports.

- *Mandatory standard n°11: Mortality management*

Poultry mortalities and cull eggs must be handled and disposed of in an approved manner. Dead birds and cull eggs may be a high-risk source of infectious disease organisms and must therefore be handled and disposed of in an approved manner.

The on-farm disposal methods that should be approved are composting, incineration and Burial. Burial is only an accepted on-farm disposal practice in areas with low rainfall and suitable ground water tables. In addition, utilization of a pick-up service for centralized disposal options such as rendering, composting or incineration are acceptable practices provided that the receiver is certified to deal with mortalities and has all relevant permits in place for the centralized facility.

If disposal does not occur immediately after the collection of mortalities the dead stock must be intermittently stored in an approved manner. The approved storage methods are:

- Impermeable covered storage bins if the storage period is short;
- Freezing in sealed bags for longer storage periods.

Specifically, the use of approved disposal and storage methods aims to ensure that all leaking fluids and dust caused by mortality management is contained at the site of disposal and does not enter the surrounding soil, water or air. It is also essential that no mortalities or poultry processing waste is mixed in with manure in order to avoid off-farm transport of un-treated bird carcasses together with manure loads. Open- or air curtain burning is not allowed as an on-farm disposal method unless a specific provincial permit exists for this practice. Furthermore, such practices as dumping of mortalities or poultry processing waste into liquid manure pits as well as feeding it to scavengers are disallowed under this mandatory standard.

6.3.3.2 Evaluation indicators

These indicators will enable the monitoring of the rates of achievements of the strategic objectives:

- Guidelines for farms access standards
- Guidelines for barns access standards
- Guidelines for flock health management standards
- Guidelines for farms management standards

6.3.3.3 Operational and invest plan

The operational and invest plan includes the stakeholders involved and the timeframe for each strategic objective

Table 17*: Operational and Investment plan for Poultry health and biosecurity*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	PRIORITY	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Capacity building for research scientists (poultry nutrition & health)	200	MINAGRI/RAB							MEDIUM TERM	50	-	150
Guidelines for parental stock and hatcheries biosecurity	50	MINAGRI/RAB, Vetservices							MEDIUM TERM	15	-	35
Guidelines for breeding farmers biosecurity	50	MINAGRI/RAB, Vetservices							MEDIUM TERM	15	-	35
Establishment of an upgrading and implementing fund of poultry farms (regulatory compliance and modern farms)	800	MINAGRI/RAB, RPIA, MINECOM, RDB							LONG TERM	100	500	200

Source: Dr Papa Ndary NIANG, 2012

6.3.4 Component 4: Development of village poultry

6.3.4.1 Strategic objectives

For many smallholders, chicken production offers a source of income that can be quickly scaled up without major investment or labour input. Village chicken improvement programs have the potential to contribute to each of the Millennium Development Goals by increasing household incomes, improving family nutrition and empowering women. Village poultry development also includes the promotion of other species reared in Rwanda in the backyard system such as ducks, turkeys and pigeons. The problem analysis tree identifies problems to solve to fully exploit the potentialities of the village poultry.

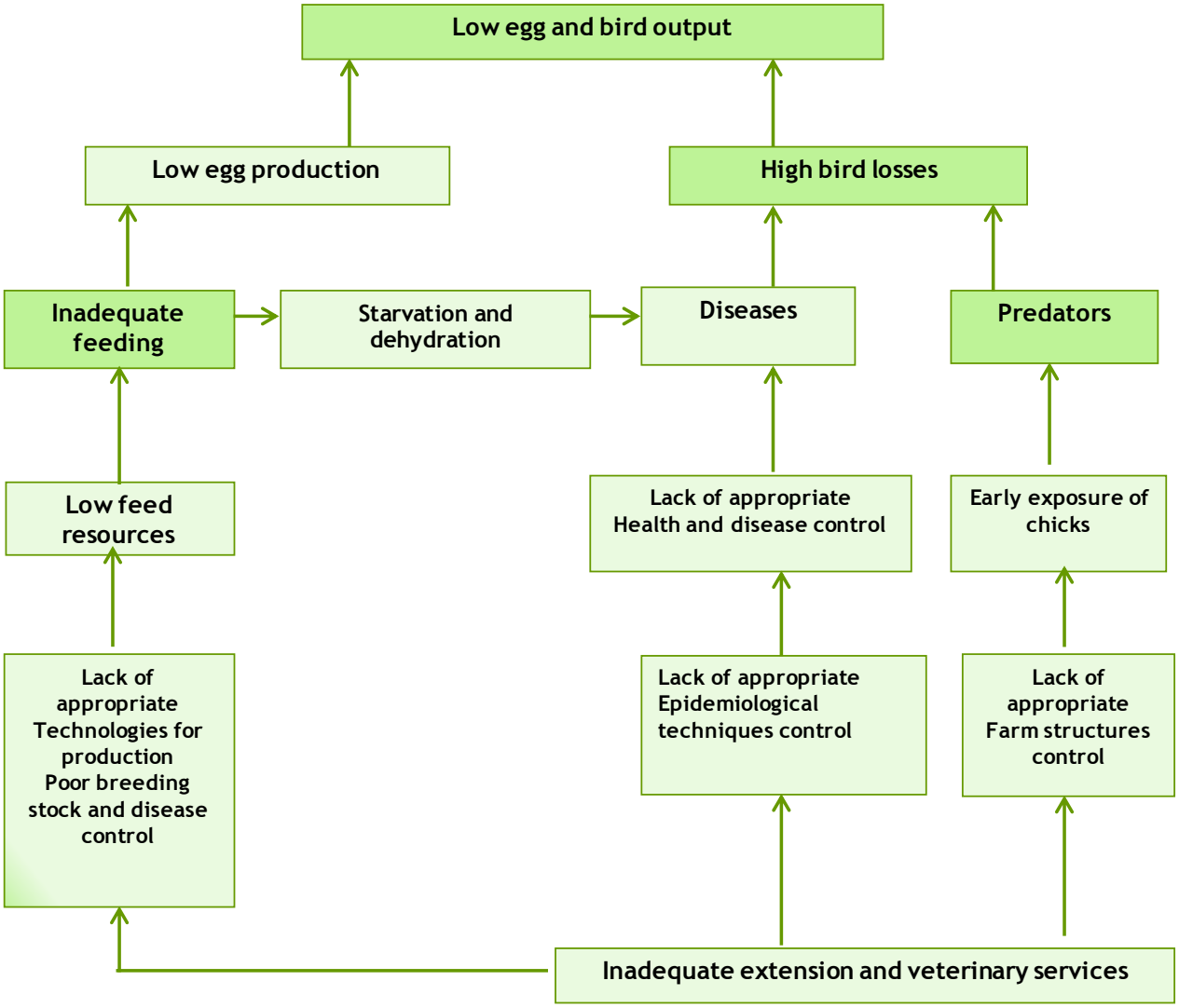


Figure 18: Problem analysis tree related to village poultry

6.3.4.1.1 Genetic improvement

Development of village poultry is unrealizable with the poor and unproductive local poultry breed. Its hardiness which enables good adaptation to harsh village management conditions is however inversely related to its productivity.

Many African countries have successfully experienced the introduction of exotic breeds whose crossbreeding with local poultry resulted in offspring well adapted and much more productive than the original breed.

Table 18 Zoo technical performances of poultry in extensive conditions

	Local breed	Bleu des Landes	Kabir	LB*BL	LB*Kabir
Egg weight (g)	44.1	62.6	63.2	52.5	53.4
hatchability	83.6%	87%	86.8%	81.9%	82.8%
Chick survival rate at week 10	59.7%	78.3%	81.2%	71.7%	70.3%
Age at first lay (months)	7-8	4-5	4-5	5-6	5-6
Adult weight, (g)	1693 (12 months)	2311 (81 days)	2261 (81 days)	1533 (81 days)	1507 (81 days)

Source: Dr Papa Ndary NIANG, adapted from (Mwalusanya et al, 2002; Castellini et al, 2002)

Cockerel exchange schemes have worked well in some areas. Cockerels of an 'improved' breed are reared by a project or Government centre. These can then be bought or exchanged by farmers so that they cross-breed with village hens. Exchanged cockerels should be exchanged with those of neighbouring farmers every year to avoid in-breeding. After four to five years the exchange programme should be repeated. As shown by the table above, genetic improvement by crossbreeding with exotic breeds is a mandatory way for improving poultry s performances in village management conditions. This condition is however insufficient due to the multiplicity of constraints.

6.3.4.1.2 Health and disease control

The problem of diseases in village chickens is compounded by the interactions of different entities that are of significant importance to disease epidemiology (figure 19). At the village level, contacts between flocks of different households, the exchange of birds as gifts or entrusting, sales and purchases are the main sources of infection transmission. Similarly, other domestic fowls and wild birds form another source of infection, because the chickens roam freely in the villages. There is a need to develop appropriate epidemiological techniques for village poultry, because of the nature of the host-pathogen-environment interaction in village chickens. The complex nature of disease epidemiology in village chickens is found both in epizootic as well as in enzootic diseases. The high helminth burden in village chicken flocks has been attributed to the scavenging diet that includes some of the hosts such as worms and snails.

Among the diseases of village chickens, Newcastle disease (ND) was ranked as the most important disease. In African countries, various initiatives led by governments and NGOs were undertaken to vaccinate chickens against ND. The most promising seems to be the training of poultry farmers to carry out simple veterinary procedures to assist community members, or farmers group, under the guidance of a veterinary officer. Other diseases affecting the poultry flock are Gumboro and Marek diseases, salmonellosis, Chronic Respiratory Disease, Bronchitis and coccidiosis. However, the latter are rather scarce in the traditional system and are mostly present in the modern system. Taking them into account is mandatory for poultry farmers to avoid economic losses due to mortality and/or morbidity. So the strategy should focus on supporting low-income traditional farmers to fight ND, which is the major threat.

The trained farmer will receive special training on how to vaccinate, disinfect and protect village poultry. Apart from the three procedures previously mentioned, the trained farmer should seek advice from a veterinary officer. A trained farmer will act as an important intermediary between veterinary officers, who in most cases are not easily accessible, and other farmers in the village or farmers groups.

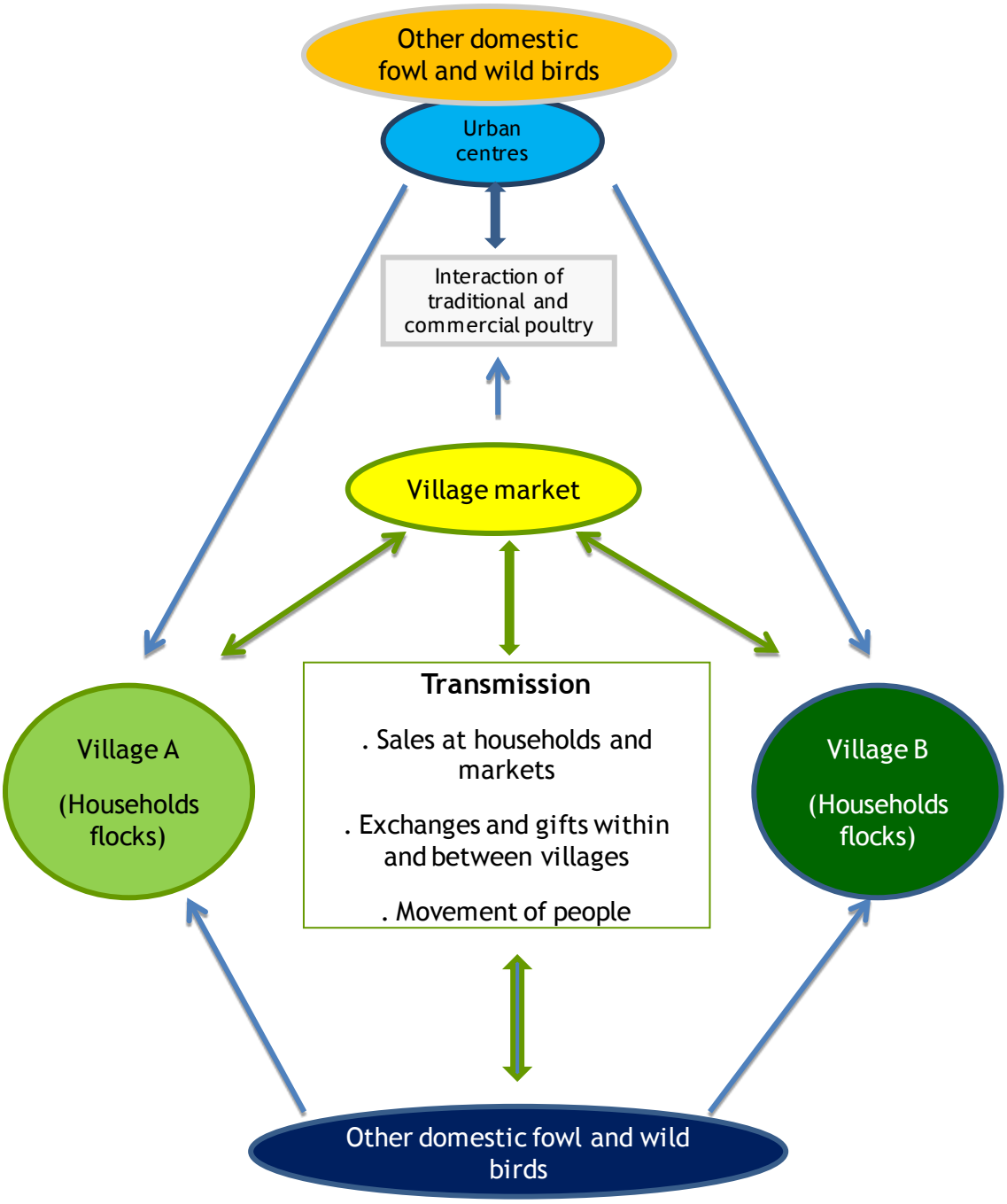


Figure 19: Village poultry production system; entities of importance in disease epidemiology

6.3.4.1.3 Housing

Poultry need a good strong house. They should be locked up at night to protect them from bad weather, predators, and thieves. A house will also allow to inspect the birds and to handle them to see if any are sick or need attention. It allows collecting their eggs from the same place. The place to build the poultry house has to be planned very carefully. The place must be shady, dry and safe on flat ground to keep the floor dry during the rainy season. It may be necessary to dig a drain around the house, or to raise the ground first.

The house can be made cheaply using local material like gumpoles, reeds and thatch grass. You must see what is available. It should be situated close to your own house with the grass and bush cleared for about 3 meters on all sides of the house to keep snakes and rats away from your chickens. Some houses are built on poles, well above the ground. This protects chickens from predators (thieves) like dogs, rats, snakes and humans.

The size of the house will depend on how many birds you have. For 10 – 15 adult birds, the size of the house should be about 2 large paces (meters) wide by 2 large paces (meters) long. It is better that the house is too big than too small.

The support of public services to poorest villagers should be manifested in the form of technical and financial assistance for meeting the requirements of adequate housing.

6.3.4.2 Evaluation indicators

These indicators will enable the monitoring of the rates of achievements of the strategic objectives:

- Implementation of unit (s) for the rearing of improved breed cockerels
- Increased rates of improved breeds in the villages flocks
- Increased rates of crossbreeds in the villages flocks
- Prevalence of the Newcastle Disease
- Mortality rates in village poultry
- Number of farmers trained for vaccination vs. Newcastle Disease
- Increased implication of women in the chain of activities
- Credit services
- Marketing assistance
- Technical assistance in feeding and housing
- Availability of village poultry statistics.

6.3.4.3 Operational and invest plan

The operational and invest plan includes the stakeholders involved and the timeframe for each strategic objective.

Table 19*: Operational and Investment plan for Development of village poultry*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	PRIORITY	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Vaccinations against Newcastle disease at village level	200	MINAGRI/RAB, NGOs							LONG TERM	50		150
Training of Newcastle Disease vaccinators	50	MINAGRI/RAB, NGOs							MEDIUM TERM	15	-	35
Purchase of breeders (KB, BL, Kroiler) and pursue the study about adaptability of exotic poultry breed to village context	20	MINAGRI/RAB							SHORT TERM	4	-	16
Development of turkeys, ducks and pigeons rearing	15	MINAGRI/RAB, NGOs							MEDIUM TERM	5	-	10

Source: Dr Papa Ndary NIANG, 2012

6.3.5 Component 5: Strengthening the institutional framework

6.3.5.1 Strategic objectives

6.3.5.1.1 Modern poultry

Any industry in its nascent stage in a competitive environment should benefit from institutional support to upgrade to its competitors. While meeting the requirements of a free market in the EAC context, poultry industry in Rwanda needs some specific measures:

- Support to professionalization of the actors
- Capacity building for poultry producers and specialists
- Implementation of poultry impulse centers
- Study the feasibility of fiscal protection
- Involvement of insurance companies (e.g. SONARWA)

6.3.5.1.2 Village poultry

A multifaceted approach is required for successful development and the adoption of improvement technologies for village chicken production systems in Africa. Where development assistance to rural poultry is accompanied by strong institutional support, the long-term effects of the assistance are promising. The programme “Integration model for the semi-scavenging systems” is cited as a successful programme on rural poultry improvement. This model tested first in Bangladesh targeted exclusively landless women and involved these women in the chain of activities of vaccination, hatchery operation, chick rearing and feed selling, as well as in the production of hatching and table eggs for the market. Credit services and marketing aspects also formed part of the model. Its success has created interest among those involved in rural development in other developing countries.

Identification of areas in the village chicken production system that require the most institutional and organizational support would enhance the adoption of methodologies used in other production systems. Input supply and distribution and product utilization are probably the key areas because of the small scale of production involved at the household flock level. Supply and distribution of veterinary drugs and vaccines is currently the main area that requires institutional and organizational support in village chicken production systems. The poor infrastructure and the small economies of scale do not attract private investment.

Supply of veterinary drugs and vaccines requires support because most of the inputs, particularly the vaccines, come in doses higher than the size of the local flocks. Group formation and credit services are therefore required in this area.

Marketing is another aspect that requires institutional and organizational support. Institutional support offered in marketing could be used to create employment for youths in rural areas. Figure 18 identifies the marketing channels of village chickens in Rwanda. Institutional and organizational support in marketing village chickens would include assistance in feeding, housing and disease control between the different marketing points.

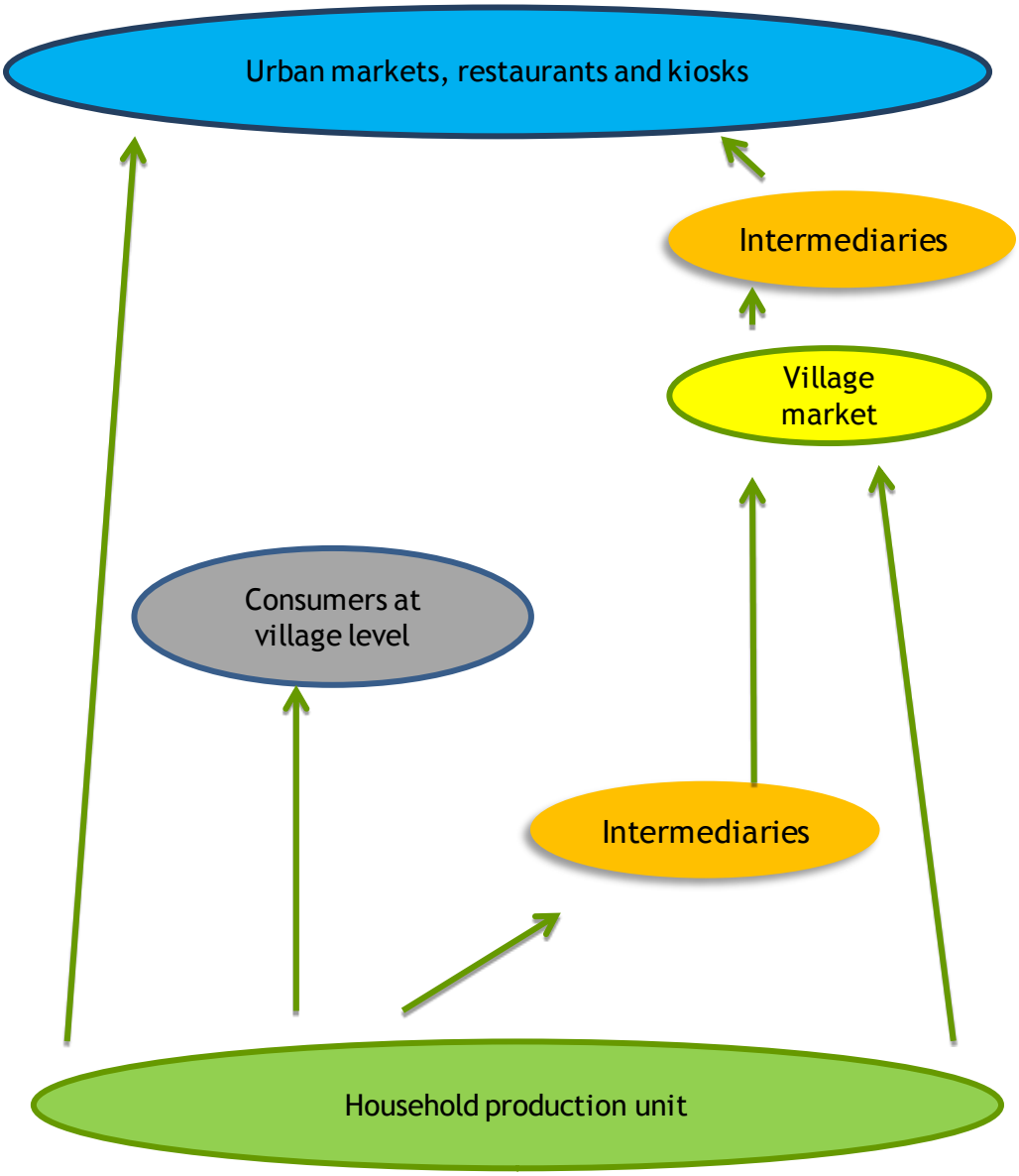


Figure 20: Marketing channel of village poultry in Rwanda

6.3.5.2 Evaluation indicators

These indicators will enable the monitoring of the rates of achievements of the strategic objectives:

- Inventory and classification of poultry actors
- Mandatory licences for mini-hatcheries
- Trained poultry specialists and producers (breeding, feed formulation, technical monitoring)
- Feasibility study for tariff and /or non tariff barriers
- Increased implication of women in the chain of activities
- Credit services
- Marketing assistance
- Technical assistance in feeding and housing

6.3.5.3 Operational and invest plan

The operational and invest plan includes the stakeholders involved and the timeframe for each strategic objective.

Table 20*: Operational and Investment plan for Strengthening the institutional framework*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	PRIORITY	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Professionalization of the sector (inventory of poultry actors, licenses for mini hatcheries, slaughterhouses, etc.)	50	MINAGRI/RAB, RPIA & other private operators (po)							MEDIUM TERM	10	15	25
Study visits for officials & farmers	120	MINAGRI/RAB, RPIA & other po							LONG TERM	20	30	70
#Training of poultry specialists (breeding management, feed formulation, technical monitoring)	90	MINAGRI/RAB, RPIA & other po							SHORT TERM	10	40	40
Capacity building for poultry producers	100	MINAGRI/RAB, RPIA & other po							LONG TERM	20	-	80
Strengthening organization of the poultry sector	50	MINAGRI/RAB/RPIA							LONG TERM	10	25	15
Establishment of impulse centers of poultry farming in provinces (2 per province)-Link with program 2 Eggs per child	400	MINAGRI/RAB, RPIA & other po							MEDIUM TERM	100	200	100
Study the feasibility of a new remission of tax on poultry products to boost the poultry industry	5	MINAGRI/RAB, RPIA, MINECOM, RDB							SHORT TERM	5	-	-
Launching concept of "30 chickens per rural family" with support in housing	1200	MINAGRI/RAB, NGOs							MEDIUM TERM	300	50	850
Organization of marketing channels of village chickens	50	MINAGRI/RAB							MEDIUM TERM	10	-	40
Feasibility study for the establishment of poultry insurance	10	MINAGRI, RPIA, Insurance Companies							SHORT TERM	10	-	-

Source: Dr Papa Ndary NIANG, 2012

6.4 Strategic axis n°2: Marketing

6.4.1 Component 1: Mastery of the sanitary quality

Meat and meat products are derived from muscle, originally uncontaminated. The slaughter and subsequent transformations undergone by these products are all risks of contamination of food by these agents (bacteria or other) from live animals (endogenous contamination) or environment itself (exogenous contamination). The dangers to the consumer through contamination of poultry meat by germs such as *Salmonella, Escherichia coli* (enterohemorrhagic strain), *Listeria monocytogenes*, and *Campylobacter jejuni* concern the possibility of outbreak of foodborne illness. The latter mostly concerns the digestive tract, but some complications may worsen the prognosis, often at the level of populations "at risk". On the other hand, consumption of improper eggs is mainly related to the risks of *Salmonella* infections (1.4 million each year in the US). Control methods in place to control the sanitary quality of the poultry industry go through analysis of the risks of contamination throughout the processing steps including the breeding and marketing. This control requires minimizing opportunities for endogenous or exogenous contamination (reducing animal infections, hygienic slaughter, further processing). It also assumes the implementation of methods to prevent microbial growth (refrigeration, vacuum packaging or controlled atmosphere ...). She finally passes through the use of methods that allow the destruction of pathogens, either in commodities themselves (cooking, pasteurization, canning ...) or at the "sources" who must be destroyed. Government and professional partners in this sector must implement the methodology for risk management (HACCP) in the context of the implementation of a new legislation regarding “Food Hygiene”.

6.4.1.1 The strategic objectives

- Fulfill the mission of protecting public health by fighting zoonoses and diseases related to poultry process (breeding and processing);
- Get Hygiene and sanitary standards in the mid-term perspectives of promoting day-old chicks, poultry meat and egg products exports;
- Protect public health by providing the consumer with products free of any danger that could compromise his health;
- Increasing consumer awareness on food quality and health;

6.4.1.2 Evaluation indicators

These indicators will enable the monitoring of the rates of achievements of the strategic objectives:

- Number of poultry farmers with HACCP approach;
- Consumers survey reports;
- Poultry slaughterhouse implemented in Kigali
- Number of guides manufacturing practice validated;
- Level of sanitary quality of poultry meat in the Rwandan market.

6.4.1.3 Operational and invest plan

The operational and invest plan includes the stakeholders involved and the timeframe for each strategic objective.

Table 21*: Operational and Investment plan for Mastery of the sanitary quality*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	PRIORITY	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Business Plan for the implementation of a poultry slaughterhouse	25	MINAGRI/RAB/ Private sector							SHORT TERM	5	-	20
Establishment of a poultry slaughterhouse in Kigali (PPP), including cutting facilities	200	MINAGRI/RAB, RPIA & other po, RDB							MEDIUM TERM	-	200	-
HACCP approach in poultry farmers	200	MINAGRI/RAB, RBS, MINICOM, NAEB, RPIA							MEDIUM TERM	10	150	40

Source: Dr Papa Ndary NIANG, 2012

6.4.2 Component 2: Promotion of the poultry products

This component will be the outcome of the previous components reviewed. Producers who raise poultry with the intent of marketing their own products (poultry meat processed or unprocessed, eggs) should give careful consideration to where they will have their poultry slaughtered or poultry meat processed. The type of plant where animals are slaughtered has a significant impact on where the meat can be marketed.

Marketing poultry meat and eggs nationally or internationally requires adequate inspection.

If the intent is to market poultry products in foreign markets, the animal must be slaughtered and processed in a certified slaughterhouse. Poultry meat and eggs inspection will be conducted by officials of MINAGRI/ VETSERVICES previously trained. New regulations containing strict facility construction and sanitation standards to ensure the safety of the poultry meat and eggs will be promoted.

Some countries require food safety standards above. The short and mid terms exports targets should be limited to bordering countries. Marketing opportunities manure in agriculture and aquaculture could be facilitated by building units of valorization of waste from poultry farms.

6.4.2.1 Strategic objectives

- Promote the consumption of poultry products produced in Rwanda.
- Understand changes in the meat market in Rwanda and the sub region and protect the Rwandan consumer;
- Make available the consumption of meat through an accessible price;
- Ensure the competitiveness of poultry meat of Rwanda;
- Anticipate the intensifying competition of poultry products from foreign countries by promoting the label «Made in Rwanda».
- Develop links between poultry farming, agriculture and aquaculture.

6.4.2.2 Evaluation indicators

These indicators will enable the monitoring of the rates of achievements of the strategic objectives:

- Growth rates of poultry (meat and eggs) per capita consumption;
- Price trends on the domestic market and sub-regional pricing structure per actor of the value chain;
- Evolution of the price of poultry products sold in the domestic market.
- Number of poultry farmers (including hatcheries) implemented and upgraded.
- Number of poultry farmers (including hatcheries) certified HACCP or obtaining a quality label.
- Number of manure units implemented

6.4.2.3 Operational and invest plan

The operational and invest plan includes the stakeholders involved and the timeframe for each strategic objective.

Table 22*: Operational and Investment plan for Promotion of the poultry products*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	PRIORITY	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Geo mapping of poultry farms, markets (GIS) and ideal areas for poultry business	50	MINAGRI/RAB							SHORT TERM	20	-	30
Subsidize producer's costs of obtaining quality certifications	120	MINAGRI/RAB, RBS, RDB, RPIA							LONG TERM	20	60	40
Harmonize quality standards of livestock products with the EAC region	15	MINAGRI/RAB, RBS, MINICOM, NAEB, RPIA							SHORT TERM	15	-	-
Labeling process for Rwandan chicken	50	MINAGRI, RAB, RSB, MINECOM, RPIA							LONG TERM		30	20
Implementation of manure units	1000	MINAGRI/Private sector							MEDIUM TERM	-	1 000	-

Source: Dr Papa Ndary NIANG, 2012

SUMMARY TABLES

Table 23*: Operational and Investment plan- Short term*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Purchase of breeders (KB, BL, Kroiler) and pursue the study about adaptability of exotic poultry breed to village context	20	MINAGRI/RAB							4	-	16
Implement 2 Animal feed manufactures (PPP)	2 000	MINAGRI/RAB, Private Sector							-	1 500	500
Upgrading quality control laboratory	400	MINAGRI/RAB, RBS							100	-	300
Recovery of the national hatchery	687.851	MINAGRI/RAB, RPIA, RDB							-	687.851	-
Geo mapping of poultry farms & markets (GIS)	50	MINAGRI/RAB							20	-	30
Business Plan for the implementation of a poultry slaughterhouse	25	MINAGRI/RAB/ Private sector							5	-	20
Harmonize quality standards of livestock products with the EAC region	15	MINAGRI/RAB, RBS, MINICOM, NAEB, RPIA							15	-	-
Training of poultry specialists (breeding management, feed formulation, technical monitoring)	90	MINAGRI/RAB, RPIA & other po							10	40	40
Study the feasibility of a new remission of tax on poultry products to boost the poultry industry	5	MINAGRI/RAB, RPIA, MINECOM, RDB							5	-	-
Feasibility study for the establishment of poultry insurance	10	MINAGRI, RPIA, Insurance Companies							10	-	-

Source: Dr Papa Ndary NIANG, 2012

Table 24*: Operational and Investment plan- Medium term*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Capacity building for research scientists (poultry nutrition & health)	200	MINAGRI/RAB							50	-	150
Training of Newcastle Disease vaccinators	50	MINAGRI/RAB, NGOs							15	-	35
Development of turkeys, ducks and pigeons rearing	15	MINAGRI/RAB, NGOs							5		10
Launching concept of "30 chickens per rural family" with support in housing	1200	MINAGRI/RAB, NGOs							300	50	850
Support the upgrade of decentralized mini-hatcheries	500	MINAGRI/RAB, RPIA, RDB							50	400	50
Organization of marketing channels of village chickens	50	MINAGRI/RAB							10	-	40
Establishment of a poultry slaughterhouse in Kigali (PPP), including cutting facilities	200	MINAGRI/RAB, RPIA & other po, RDB							-	200	-
HACCP approach in poultry farmers	200	MINAGRI/RAB, RBS, MINICOM, NAEB, RPIA							10	150	40
Professionalization of the sector (inventory of poultry actors, licenses for mini hatcheries, slaughterhouses, etc.)	50	MINAGRI/RAB, RPIA & other po							10	15	25
Etablish quality standards for poultry feed	100	MINAGRI/RAB, RBS, Private sector							15	75	10
Research – development linkages to formulate poultry diets matched with the feed resources locally available	200	MINAGRI/RAB, NUR, UPU							50	50	100
Guidelines for parental stock and hatcheries biosecurity	50	MINAGRI/RAB, Vetservices							15	-	35
Guidelines for breeding farmers biosecurity	50	MINAGRI/RAB, Vetservices							15	-	35
Establishment of impulse centers of poultry farming in provinces (2 per province)	400	MINAGRI/RAB, RPIA & other po							100	200	100

Source: Dr Papa Ndary NIANG, 2012

Table 25*: Operational and Investment plan- Long term*

	BUDGET (in RWF)*10^6	STAKEHOLDERS	2012	2013	2014	2015	2016	2017	RWANDA GOVERNMENT CONTRIBUTION	PRIVATE SECTOR CONTRIBUTION	PARTNERS of DEVELOPMENT CONTRIBUTION
Vaccinations against Newcastle disease at village level	200	MINAGRI/RAB, NGOs							50		150
Subsidize producer's costs of obtaining quality certifications	120	MINAGRI/RAB, RBS, RDB, RPIA							20	60	40
Labeling process for Rwandan chicken	50	MINAGRI, RAB, RSB, MINECOM, RPIA								30	20
Study visits for officials & farmers	120	MINAGRI/RAB, RPIA & other po							20	30	70
Capacity building for poultry producers	100	MINAGRI/RAB, RPIA & other po							20	-	80
Strengthening organizations of the poultry sector	50	MINAGRI/RAB/RPIA							10	25	15
Establishment of an upgrading and implementing fund of poultry farms (regulatory compliance and modern farms)	800	MINAGRI/RAB, RPIA, MINECOM, RDB, BRD, BPR							100	500	200

Source: Dr Papa Ndary NIANG, 2012

7 LOGICAL FRAMEWORK

The logical framework is given by the table below.

Table 26*: The logical framework*

OBJECTIVES	Indicators	Means of verification	Assumptions
Overall objective: Making the poultry industry a flagship of the Rwandan livestock.	• The poultry flock will increase from 4 081 000 to 10677269 heads • Poultry meat production will increase from 5400 T to 14414 T • Egg production will increase from 2900 T (36 million units) to 11305 T (140 million units)~ 11 718 T • 90% reduction of Poultry meat imports • 80% reduction of egg imports • 56% of DOCs market share for Rubilizi and mini hatcheries	• MINAGRI ANNUAL REPORTS • MINICOM ANNUAL REPORTS	At the end of the action plan, the poultry meat per capita consumption will be increased, as well as incomes of modern poultry and village poultry owners, with an availability of financial means in poultry industry.
Specific objectives: • Increasing poultry meat supply • Increasing egg supply • Improving access to domestic and foreign markets	• Poultry meat production will increase from 5400 T to 14414 T • Egg production will increase from 2900 T (36 million units) to 11305 T (140 million units)~ 11 718 T • 99% reduction of Poultry meat imports • 90% reduction of egg imports • 56% of DOCs market for Rubilizi and mini hatcheries • 10% poultry meat exports to foreign markets • 10% egg exports from to foreign markets	• MINAGRI ANNUAL REPORTS • MINICOM ANNUAL REPORTS	At the end of the Action Plan the poultry industry will enable the filling of the domestic market and begin to export to regional markets.

Outputs:			
1. Poultry nutrition	• Quantities of cereals grains, vegetable and animal protein sources • 2 poultry nutrition specialists in MINAGRI/RAB • Quantities of industrial poultry feed	• MINAGRI ANNUAL REPORTS	Availability of poultry feed industry that can support the intensification of poultry meat and egg production Availabilty of poultry nutrition specialists in Rwanda
2. Supply of DOCs	• 2 poultry parent stock rearing specialists in MINAGRI/RAB • Guidelines for parent stock rearing • National hatchery supplies 150 000 DOCs per month • Mini-hatcheries supply 35 000 DOCs per month	• MINAGRI ANNUAL REPORTS	By the end of the Action Plan, the National Hatchery will supply 45% of DOCs, the decentralized mh 11% and the imports 44%
3. Poultry health and biosecurity	• Prevalence of major poultry diseases: ND, Gumboro, Salmonellosis, Coccidiosis	• ANNUAL REPORTS MINAGRI/VETSERVICES • ANNUAL REPORTS OIE	No new outbreaks of major poultry diseases in Rwanda Availability of vaccines
4. Development of village poultry	• Village poultry vaccinated against ND: 873 415 (2012) to 2 million (2017). • . 11 mandatory standards regarding farms access, barns access, flock health management and farms management • Purchase of 10000 chicks «bleu des landes», «Kabir», «Kuroiler» • Village chickens vaccinated against ND: 873 415 (2012) to 2 million (2017). • 2000 family per province (10000	• MINAGRI ANNUAL REPORTS	Availability of poultry in village No new outbreaks of major epidemic poultry diseases in Rwanda Development of village poultry farmers

	family in the country) provided with chicken and housing assistance • Number of village chickens vaccinated against Newcastle disease • Population of village poultry: chickens, turkeys, ducks, pigeons		
5. Strengthening the institutional framework	• Rubilizi share Capital • 10 licenses granted for mini hatcheries • Number of poultry farmers trained • .2 impulse centers per province • Level of poultry sanitary quality • Contribution of development partners • Number of requests approved • Volume of funds	• MINAGRI ANNUAL REPORTS • MINECOFIN ANNUAL REPORTS • NATIONAL BANK OF RWANDA ANNUAL REPORTS • BRD REPORTS • BPR REPORTS • INSURANCES COMPANIES REPORTS	The institutional support will gradually decrease giving place to strong stakeholder's organizations and skilled farmers
6. Mastery of sanitary quality	• 4 training programs/year • Number of guides manufacturing practice validated; • Number of poultry farmers with HACCP approach; • 1Consumers survey report per year; • 1Poultry slaughterhouse implemented in Kigali	• MINAGRI ANNUAL REPORTS • MINICOM ANNUAL REPORTS • RBS ANNUAL REPORTS	At the end of the action plan, availability of quality poultry meat and eggs meeting the requirements of public health and exports standards
7. Promotion of the poultry products	• 10 mini hatcheries upgraduaded and certified • Satisfaction rate of consumers (poultry sold in pieces to increase affordability)	• MINAGRI ANNUAL REPORTS • MINICOM ANNUAL REPORTS	Widespread acceptance of locally produced poultry meat and eggs

	• Incomes of Poultry farmers and SMEs solvability • Poultry meat production will increase from 5400 T to 14414 T • Egg production will increase from 2900 T (36 million units) to 11305 T (140 million units)~ 11 718 T • Monthly assessments of poultry meat and egg prices in domestic and regional markets • 5 consumers' associations • 1 consumers survey report/year • 50% reduction of Meat imports • Number of labeled products • 5 manure units implemented	• RBS ANNUAL REPORTS	

ACTIVITIES	BUDGETS	STARTING CONDITIONS
	9 157 850 666 RWF	
Output 1: Poultry nutrition	**2 700 000 000 RWF**	• *Harmonization of the 3 Action Plans: «Meat industry strategy»; «Small animal industry strategy» and «Poultry industry strategy»*
1.1. Implementation of 2 Animal feed manufactures (PPP)	**2 000 000 000**	
1.2. Upgrading quality control laboratory	**400 000 000**	• *Communication plan of the strategy with stakeholders, authorities and development partners which support 33% of the budget*
1.3. Establish quality standards for poultry feed	**100 000 000**	
1.4. Research – development linkages to formulate poultry diets matched with the feed resources locally available	**200 000 000**	• *Calls for expressions of interest to select the private investors, which support 55% of the budget*

	1 187 850 666 RWF	• *Deposit of the government counterpart (12%)*
Output 2: Supply of Docs	**687 850 666**	
2.1. Recovery of the national hatchery	**500 000 000**	
2.2. Support the implementation and upgrade of decentralized mini-hatcheries	**1 100 000 000 RWF**	• *Implementation of operational action plan through coaching (regular meetings, monitoring and evaluation, strategic dashboard). this component could be done in collaboration with a consultancy firm*
Output 3: Poultry health and biosecurity	**200 000 000**	
	50 000 000	
3.1. Capacity building for research scientists (poultry nutrition & health)	**50 000 000**	
3.2. Guidelines for parental stock and hatcheries biosecurity	**800 000 000**	
3.3. Guidelines for breeding farmers Biosecurity		
3.4. Establishment of an upgrading and implementing fund of poultry farms (regulatory compliance and modern farms)	**285 000 000 RWF**	
	200 000 000	
Output 4: Village poultry	**50 000 000**	
	20 000 000	
4.1. Vaccinations against Newcastle disease at village level	**15 000 000**	
4.2. Training of Newcastle Disease vaccinators		
4.3. Purchase of breeders (KB, BL, Kroiler) and pursue the study about adaptability of exotic poultry breed to village context		

4.4. Development of turkeys, ducks and pigeons rearing	**2 075 000 000 RWF** **50 000 000**	
Output 5: Institutional framework	**120 000 000**	
5.1. Professionalization of the sector (inventory of poultry actors, licenses for mini hatcheries, slaughterhouses, etc.)	**90 000 000**	
5.2. Study visits for officials & farmers	**100 000 000**	
5.3. Training of poultry specialists (breeding management, feed formulation, technical monitoring)	**50 000 000**	
5.4. Capacity building for poultry producers	**400 000 000**	
5.5. Strengthening organization of the poultry sector	**5 000 000**	
5.6. Establishment of impulse centers of poultry farming in provinces (2 per province)-Link with program 2 Eggs per child	**1 200 000 000**	

	50 000 000	
5.7. Study the feasibility of a new remission of tax on poultry products to boost the poultry industry	**10 000 000**	
5.8. Launching concept of "30 chickens per rural family" with support in housing	**425 000 000 RWF**	
	25 000 000	
5.9. Organization of marketing channels of village chickens	**200 000 000**	
5.10. Feasibility study for the establishment of poultry insurance	**200 000 000**	
Output 6: Mastery of the sanitary quality	**1 235 000 000 RWF**	
6.1. Business Plan for the implementation of a poultry slaughterhouse	**50 000 000**	
6.2. Establishment of a poultry slaughterhouse in Kigali (PPP), including cutting facilities	**120 000 000**	
6.3. HACCP approach in poultry farmers	**15 000 000**	
Output 7: Promotion of the poultry products	**50 000 000**	
7.1. Geo mapping of poultry farms & markets (GIS)	**1000 000 000**	
7.2. Subsidize producer's costs of	**150 000 000 RWF**	

obtaining quality certifications 7.3. Harmonize quality standards of livestock products with the EAC region 7.4. Labeling process for Rwandan chicken 7.5. Implementation of manure units **<u>Output 8: Transversal action: coaching of the Action Plan</u>**		

8 INVESTMENT IN LIVESTOCK; A WISE CHOICE FOR AFRICAN COUNTRIES

The implementation of the strategic and investment plan must involve three categories of stakeholders: government, private sector and partners of development: yet the major impetus must come from the government in relation to its goals of economic growth and poverty reduction. The World Bank has developed an instrument for measuring the impacts of public investments in livestock in economic growth of African countries.

8.1 Relationships between Livestock development and economic growth

The relevance of the implementation of livestock development projects in developing countries must be judged by their contribution in economy growth and poverty alleviation.

The World Bank World Development Report on Agriculture for Development (WDR) advocated in 2008 for a smallholder-based 'productivity revolution', particularly for staple food in agriculture based countries of sub-Saharan Africa.

A test of the causal relationship between growth in livestock sector productivity and per capita GDP in a sample of 18 African countries shows that increases in livestock sector productivity tended to precede growth in per capita GDP in the majority (16/18) of sample countries, many of which are agricultural -based.

The test was developed by the Pro-Poor Livestock Policy Initiative (PPLPI), launched in 2001 by the Animal Production and Health Division of the FAO.

- *The hypothesis*: a wide array of economic literature has documented that increased agricultural productivity triggers economic growth and poverty alleviation in developing countries (Datt and Ravaillon, 1998; Gallup et al., 1997; Irz et al., 2001; Winters et al., 1997). Given the share of livestock value-added in agriculture increases as economic development progresses, up to over 50 percent in most industrialized countries, the PPLPI research group hypothesized that increases in livestock productivity act as a stimulus of economic growth on their own right.
- *The methodology*: Drawing on the World Bank's World Development Indicators Database (World Bank, 2007) and FAO's Internal Statistical Database (FAO, 2007), a panel dataset spanning the period 1961 to 2003 for a total of 18 African countries was assembled. Per capita GDP (constant 2000 US$) is taken as an indicator of level of development as well as of the demand for animal food; livestock productivity (constant 2000 US$) is measured by value added per tropical livestock unit (TLU). To

trace the causality between GDP growth and livestock productivity Granger causality test (1969) was used and the methodology developed by Toda and Yamamoto (1995) applied (See Appendix 1).

- *The results*: The following table summarizes the empirical results for the African countries in which a significant relationship (at 5 percent level) was found between GDP growth and livestock productivity growth.

Table 27: Countries exhibiting causality between growth of livestock productivity (VA) and growth in per capita GDP

Country	Livestock VA ⇨ GDP		GDP ⇨ Livestock VA	
	Stat.	Prob.	Stat.	Prob.
Burundi**	9.48	0.01	22.31	0.00
Central African Rep.*	4.56	0.03	1.62	0.20
Congo DRep.*	53.13	0.00	1.76	0.62
Congo rep.*	4.06	0.04	1.12	0.29
Gambia*	13.09	0.00	3.08	0.21
Guinea Bissau*	39.88	0.00	1.10	0.58
Ghana*	15.14	0.00	2.57	0.28
Kenya*	8.90	0.01	1.63	0.44
Lesotho*	9.21	0.01	0.59	0.74
Madagascar*	7.22	0.03	1.87	0.39
Malawi**	41.39	0.00	9.63	0.01
Niger*	40.54	0.00	12.77	0.00
Nigeria**	21.13	0.00	7.64	0.02
Senegal*	8.83	0.00	0.67	0.41
South Africa**	8.25	0.02	6.85	0.03
Sudan*	18.71	0.00	1.04	0.6
Togo***	0.43	0.51	4.22	0.04
Zambia***	0.99	0.61	6.20	0.05

* Countries exhibiting causality from growth of livestock productivity to growth in per capita GDP; ** countries exhibiting bi-directional causality; *** countries exhibiting causality from growth in per capita GDP to growth in livestock productivity

In 16 of the 18 countries analyzed, that is in almost 90 percent of the sample, a statistically significant causal relationship was found between livestock sector development and economic growth. Almost all these countries are agricultural-based. In 16 of the 18 countries in which a statistically significant relationship was found, livestock sector development appears to be / have been a driver of per capita GDP growth; in four of these countries a bi-directional causality was also found. Only in two countries (Togo, Zambia), increases in livestock sector productivity appear to be /

have been driven by per capita GDP growth.

8.2 Findings and policy implications

The finding that increases in livestock sector productivity are associated with economic growth in 16 of the 18 countries in which a statistically significant relationship was found appears plausible. There is a large body of economic literature which shows that increased agricultural productivity is anticipated to lead to lower food prices that directly benefit the poor and also generate a surplus of products and factors that can be exported from agriculture to the rest of the economy, thereby facilitating economic growth and poverty alleviation. Historical evidence largely supports this hypothesis. First, globally prices for agricultural products, including those of livestock products, have declined by about 0.5 to 0.7 percent per year relative to those of other goods since 1900 (Mundlak, 1990), though some major increases have been recorded in the last years. Second, a number of studies have empirically documented that agricultural growth supports broad-based economic growth. Timmer (2002) finds that over the period 1960 to 1985 in a sample of 65 developing countries past growth in agricultural GDP has a significant impact on current non-agricultural sector growth; Bravo-Ortega and Lederman (2005) replicate the analysis by Timmer for the 1960 to 2000 period and obtain similar results, although they find some heterogeneity across regions. For instance, in the case of Latin America, the impact appears weaker than in the case of other developing regions, such as in our results. They also find a significant impact of non-agricultural growth rates on agricultural growth, which suggests that the causality can run both ways. Tiffin and Irz (2006) test for the direction of causality between agricultural value-added per worker and gross domestic product in 85 countries and conclude that agricultural value-added is the 'causal' variable in the majority of developing countries, such as our results suggest too.

Overall, PPLPI findings indicate that the orthodox paradigm of increased agricultural productivity being a driver of economic growth in developing countries also applies to the livestock sector on its own right, possibly because of the increased contribution to the sector in agricultural value added along the process of economic development. The implications of these findings are that the WDR's vision of the livestock sector as primarily driven by exogenous demand factors can be misleading in terms of policy conclusions. Whereas some priority should certainly be given to policies which allow smallholders to profitable sell meat and milk in high-value markets, policies which address the fundamental constraints to livestock sector development, such as for instance inadequate access to forage, water and basic animal health services appear equally relevant.

In others words, the productivity revolution the WDR envisages for smallholder farmers should not

only include basic staples but also livestock products, which are not only high-value products for better-off consumers but also basic food items for many rural communities in developing countries.

8.3 Appendix

Granger (1969) defined a simple concept of causality by which a cause has to precede the effect: if per capita GDP growth affects productivity in the livestock sector, knowledge of the former should improve predictions of the latter (or vice versa). To avoid issues related to non-stationarity and co-integration, we apply the methodology developed by Toda and Yamamoto (1995) who showed that, irrespective of whether the variables involved are stationary or not and regardless of the existence of a co-integrating relationship among them, tests for Granger non-causality can be performed by estimating a Vector Autoregression Model VAR(p + dmax), where p is the optimal lag length in the original VAR system and dmax is the maximum order of unit roots in the variables of the model. The following VAR model are estimated:

$$gdp_t = \alpha_{11}\, gdp_{t-1} + ... + \alpha_{1d}\, gdp_{t-d} + \beta_{11}\, live_{t-1} + ... + \beta_{1d}\, live_{t-d} + \varepsilon_{1t} \quad (1)$$

$$live_t = \alpha_{21}\, live_{t-1} + ... + \alpha_{2d}\, live_{t-d} + \beta_{21}\, gdp_{t-1} + ... + \beta_{2d}\, gdp_{t-d} + \varepsilon_{2t} \quad (2)$$

where gdp_t is per capita GDP in year t; $live_t$ is livestock value added per TLU in year t; $d = p + d_{max}$ is the number of time lags included in the model; εt is the error term. The Granger non-causality test is a modified Wald test on the parameters of the true VAR (p) model, i.e. it involves testing $\beta_{i1}=\beta_{i2}=\ldots=\beta_{ip}=0$ for each equation with the remaining d_{max} parameters regarded as zeros. This test has an asymptotic $\chi 2$ distribution when the augmented VAR ($p + d_{max}$) is estimated. Estimating the above VAR requires three steps. First, Augmented Dickey Fuller (ADF) tests was used with trends to determine the number of units roots for both GDP and livestock productivity in the sample countries. The Schwarz Information Criterion (SIC) is used to determine the lag structures in the ADF tests. Second, the Akaike's Final Prediction Error (FPE) criterion was used to select the optimal lag length in the VAR models for each sample country. Finally, Seemingly Unrelated Regressions (SUR) are used to estimate the VAR systems and perform the modified Wald tests on the relevant coefficients, as these tests experience efficiency improvement when SUR models are used in the estimation (Rambaldi and Doran, 1996). The null hypotheses are tested at the 5 percent significance level.

9 BIBLIOGRAPHY

1. **AFRICAN UNION INTERAFRICAN BUREAU FOR ANIMAL RESOURCES,** Strategic plan 2010-2014, December 2009, Nairobi, Kenya.
2. **AFRIQUE EMERGENCE CONSEIL Senegal Ministry of Livestock.** Strategic and investment plan 2011-2018 to strengthen Poultry value chain in Senegal.
3. **AVITALIA, unione nazionale associazioni du produttori avicunicoli,** Production and world market: the rabbit in the European Union.
4. **BC FOOD PROCESSORS ASSOCIATION,** Strategic Plan for Sustainable Food Safety for BC Post licensing transition: the meat sector and beyond 2011 – 2013, 25 July 2011.
5. **BISTER Jean-Loup,** Genetic improvement strategy of small stock. Final Report, 2010.
6. **BRUINSMA JELLE,** World agriculture: towards 2015/2030 AN FAO PERSPECTIVE, FAO 2003.
7. **BUTERA Jean-Bosco & RUTAGWENDA Theogen, MINAGRI GECAD,** Plan stratégique de transformation de l'agriculture au Rwanda, Animal production sub-sector, 2004.
8. **CASTELLINI et al.,** Performance and behaviour of chickens with different growing rate reared according to the organic system, 2002.
9. **CENTURION POULTRY INC,** Early bird parent stock management guide. 2009 edition.
10. **CENTURION POULTRY INC,** Pure line Genetics SAGITTA Parent stock Management Guide. 2007.
11. **CLARKE MICHAEL,** Poultry Industries Research, Development and Extension Strategy. A national assessment of capabilities to ensure innovation that improves productivity and delivers public good outcomes, 15 March 2010.
12. **COTTRILL KEVIN, Chief executive officer,** Meat Industry Strategic Plan 2010-2015, RMAC board final, version 5.0 (5/6/2009), AMIC (Australian Meat Industry Council).
13. **DE GROOTE H. AND ODENDO M.** Analysis of the spatial and temporal volatility of maize prices in Kenya: a preliminary analysis CIMMYT-Kenya, P.O. Box 1041 Village Market 00621, Nairobi, Kenya Johnny Harrison. Zootecnica Russian Edition, April/May 2006.
14. **DEPARTMENT OF FISHERIES & ANIMAL RESOURCES DEVELOPMENT, GOVERNMENT OF ORISSA.** Project Proposal for Strengthening of Special Poultry Unit, Chipilima for establishment of 45,000 numbers capacity Parent Stock of Poultry (Dual purpose of low-input technology birds) to produce hatching eggs.2009.
15. **FARREL, DAVID.** A simple guide to managing village poultry in South Africa. Durban, 2008.
16. **FAO.** Food outlook 2011.
17. **FAO,** Development of rural poultry production, final report. Report, June 2006.
18. **HYBU CIG CYMRU Meat promotion Wales,** Strategic Action Plan for the Welsh Red Meat Industry, A profitable, efficient, sustainable and innovative Welsh red meat industry, which responds competitively to ever changing market trends and benefits the people of Wales, 28 April 2009.
19. **KALLA ET AL,** 2007. Economic analysis of broiler production at Miango state, Nigeria. Farm management association conference.
20. **KANYANDEKWE, CHRISTINE – RAB/ Animal Resources Extension,** Overview of the poultry industry in Rwanda, 06 Oct 2011.

21. **MAPENDO**, **ISIDORE GAFARASI** Poultry sector country review: RWANDA, KIGALI, FAO March 3, 2010.

22. **MAYIGANE**, **LANDRY NDRIKO** Overview of the poultry industry in Rwanda, 2011.

23. **MAYIGANE**, **LANDRY NDRIKO, KANYANDEKWE**, **CHRISTINE.** Development of poultry industries (July 2010 - June 2011).

24. **MAYIGANE**, **LANDRY NDRIKO**, Formules d'aliments volaille au couvoir national, 2012.

25. **MAYIGANE**, **LANDRY NDRIKO,** Newcastle Disease Vaccination Campaign March-May 2012.

26. **MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES,** National Post-Harvest Staple Crop Strategy, October 2011.

27. **MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES**, Post-Harvest Handling, Storage & Marketing Strategy, December 2010.

28. **MINISTRY OF FINANCE AND ECONOMIC PLANNING,** Rwanda vision 2020, Kigali, July 2000.

29. **MWALUSANYA et al.** Productivity of local chicken under village management conditions. Tropical animal health and production. Vol. 4, n^{o} 52002, 2002

30. **NATIONAL INSTITUTE OF STATISTICS OF RWANDA,** GDP Annual Estimates 2010/11 based on 2006 benchmark, September 2011.

31. **NATIONAL INSTITUTE OF STATISTICS OF RWANDA,** Statistical yearbook 2011 edition.

32. **NORTHERN IRELAND RED MEAT INDUSTRY TASK FORCE:** Strategy Review, Volume 1 – Main Report October 2007.

33. **PAUL HEIDLOFF OF WILLIFORD**, **Arkansas, USA**, Strategy and Investment Plan to Strengthen the Poultry Industry in Rwanda, 13 February 2012.

34. **PERMIN A., RIISE J.C., KRYGER, K.N,** Strategies for developing family poultry production at village level - Experiences from West Africa and Asia. Network for Smallholder Poultry Development (NSDP), Dyrlaegevej 2, 1870 Frederiksberg, Denmark.

35. **PROFESSIONAL SOLUTIONS INTERNATIONAL LLC,** Malawi Poultry Corporation, Business Plan 2005.

36. **PSTA II,** Strategic Plan for the Transformation of Agriculture in Rwanda – Phase II, Final Report February 2009.

37. **REPUBLIC OF RWANDA,** Economic development and poverty reduction strategy 2008-2012, Sept 2007.

38. **RIU (Research Into Use),** Poultry sector development validation workshop. MAMBA POINT HOTEL, WILBERFORCE, FREETOWN, 25 August 2010.

39. **RUHANA MIRINDI RWAHAMA KWETU,** rapport provisoire identification de la filière avicole, 2011.

40. **RUZIBIZA JEAN CLAUDE** President of Rwanda poultry industry association, Poultry industry in Rwanda,2011.

41. **RWANDA AGRICULTURE BOARD**, Poultry program-Action plan 2012-2013.

42. **RWANDA AGRICULTURE BOARD**, Field report of the animal nutrition in Rwanda**,** 2012.

43. **RWANDA AGRICULTURE BOARD,** H a n d – o v e r between former director general of RAB (outgoing) and new director general of RAB, 19 march 2012.

44. **RWANDA AGRICULTURE BOARD** Action Plan for 2012-2013.

45. **RWANDA AGRICULTURE BOARD***,* RUBIRIZI HATCHERY Current status, 06 Oct 2011.

46. **RWANDA AGRICULTURE BOARD**, Production cost of a broiler day old chick at the national hatchery, 2011-2012.

47. **TABITHA KIMANI AND ALEX NYARKO,** Rwanda poultry value chains, national and cross-border trade flows, 2011.

ANNEX

Table 28*: Meetings with stakeholders*

LOCATION	STAKEHOLDERS	FUNCTION
MINAGRI	Ernest RUZINDAZA	Permanent Secretary
MINAGRI	Dr Theogene RUTAGWENDA	Director General of Animal Resources
MINAGRI	Raphael RURANGWA	Director General of Planning & Programme coordination
MINAGRI	Didace RUSHIGAJIKI	Professional in charge of Poultry & Pigs
RWANDA AGRICULTURE BOARD	Dr Christine KANYANDEKWE	Deputy Director General RAB/Animal Extension
RWANDA AGRICULTURE BOARD	Dr Alphonse NSHIMIYIMANA	Director of Animal Production RAB
RWANDA AGRICULTURE BOARD	Dr. Landry Ndriko MAYIGANE	Director of the National Poultry Program
PROGRAMME D'APPUI AU PETIT ÉLEVAGE (APEL)	Luc de BRUYNE	Director APEL
PROGRAMME D'APPUI AU PETIT ÉLEVAGE (APEL)	Dr Fabrice NDAYISENGA	Coordinator Small Stock Program RAB & Director of Operations APEL Program
RWANDA DEVELOPMENT BOARD (RDB)	Clare AKAMANZI	Chief Operating Officer
RWANDA DEVELOPMENT BOARD (RDB)	Rita UMURERWA	Dairy, Meat and Poultry Account Manager
DIRECTION VETERINARY SERVICES	Dr David KIIRA Dr Otto Vianney MUHINDA	Virology specialist Director of Veterinary Services
MINAGRI	Felix NYIRISHEMA Dr Vincent NIYIRAGIRA	Cattle Development MINAGRI Veterinary inspection ARE/RAB
MUSANZE	Jean-de-Dieu MANIRAKIZA	Poultry farmer
KIGALI	Jean-Claude RUZIBAZA Oleg STENBOCK	Managing Director RWANDA BEST, Poultry farmer Director RWANDACHICK Ltd, Poultry farmer
RWANDA BUREAU OF STANDARDS (RBS)	Prisca MUKARUMONGI Angeline WIBABARA Yves Severin RWIGIMBA	Librarian RBS Librarian RBS Certification Bureau

	Eric NIGABA	Market Surveillance
MINICOM	Gradence MUKAMURENZI	AG Director International trade Department
RWANDA AGRICULTURAL BOARD (RAB)	Dr Joy MUHUMUZA	Small Stock Program
RUBILIZI HATCHERY (MINAGRI)	Syridion DUSABIMANA	Rubilizi Hatchery Manager
SOPAR (Feed Manufacture)	Jean de Dieu MUSABYIMANA	Casher
GASOGI	Mbuto AIMABLE	Mini Hatchery Manager
MINAGRI	Dr Isidore NSENGIMANA	Professional in charge of animal quarantine
RULINDO/ RUSIGA (Northern Province)	Jean Marie Vianney NGIRUWONSANGA	Poultry farmer
AGROTECH (Kigali)	Evariste SAFALI	Marketing Manager