Moroccan Journal of Agricultural Sciences
Vol 4 No 3 (2023): (September 2023)
Animal Production and Health

Economic analysis of the traditional Beldi Chicken value chain in Morocco

Mohamed SMAITI Hassan II Institute of Agronomy and Veterinary Sciences, Rabat, Morocco
Rachid HARBOUZ Hassan II Institute of Agronomy and Veterinary Sciences, Rabat, Morocco
Hayat LIONBOUI National Institute of Agronomic Research, Agadir, Morocco
Fouad ELAME National Institute of Agronomic Research, Agadir, Morocco

Poultry meat production in Morocco has experienced a considerable growth over the past two decades. Indeed, the poultry sector has a significant economic weight in Moroccan agriculture with 23.3 million days of labor and 9.9 billion dirhams in added value in 2019. However, there is a huge gap between the traditional and industrial poultry sectors in terms of production, processing, promotion and support. This work focuses on the traditional beldi chicken value chain in the Morocco. Its general objective is to contribute to the detailed economic analysis of the “Beldi” chicken value chain. In addition, this study will analyze the main factors that determine the income from traditional chicken production. We note that the traditional Beldi chicken sector is characterized by a high degree of informality, which can make it difficult to track supply and demand and ensure fair prices for all actors of the value chain. It represents an important source of income for small farmers and the most deprived families and contributes to reducing poverty.

Keywords: Poultry, Traditional Beldi Chicken, value chain, actors, income, poverty

INTRODUCTION

The poultry sector in Morocco has experienced considerable growth over the past three decades. It has a very significant socio-economic weight in Moroccan agriculture with 23.3 million working days and 9.9 billion in added value, offering 140,000 direct jobs and 320,000 indirect jobs. In 2020, the national production of poultry meat is 635,000 tons and 5.5 billion eggs for consumption. The sector currently covers 100% of poultry meat needs representing 55% of total consumption of all meats combined and 100 % of table egg requirements (FISA, 2020).

On the sidelines of intensive poultry farming, coexists extensive poultry farming, which is practiced in the majority of the Moroccan territory. The products of this farming are known as traditional “Beldi” chickens. It is a village chicken produced by Moroccan local farms and some households. It is a type of farming practiced mainly in rural areas, under an extensive mode where each peasant family has a relatively small number of hens (Raveloson, 1990).

The traditional Beldi chicken is well distributed throughout the country with particular geographical concentrations linked to the severity of the climate (North-South and West-East gradients) and to the demographic distribution. Traditional Beldi chicken poultry remains widespread in rural areas. In Morocco, 50,000 tons of poultry meat and 800 million eggs produced would come from traditional farms (FISA, 2020). Traditional poultry farming is of great importance, particularly in socio-cultural, nutritional, socio-economic terms, and contributes to poverty alleviation in rural areas. It plays an important role in providing protein of animal origin, generally of high quality, for rural and urban households. From a socio-cultural point of view, it has an important role in ceremonies and religious events. Despite the decline in the proportion of traditional poultry livestock over the years, it has an important interest in the formation of rural

household income, particularly, poor households.

However, this sector is often neglected in comparison to other agricultural activities due to its low impact on household revenue. Indeed, there is not an important interest in Beldi chicken for the fight against infectious diseases. The neglect of this poultry farming is also noted on the genetic level with lack of conservation programs of local genetic resources (El hadoufi, 1992; Fagrach et al., 2021).

Several works carried out on traditional or village poultry farming have focused on nutritional, health and zootechnical aspects. However, no study has dealt with the economic aspect of the Beldi chicken sector at the national level, hence the interest of this study which attempts to apprehend the chicken value chain in the Moroccan territory. The main specific objectives are to identify the main players in the chicken Beldi value chain, their functions and their relationships, to map the different actors, the revenues and margins of the actors in the value chain and finally the determinants of the income from Beldi chicken farmers.

THE POULTRY SECTOR IN MOROCCO

National poultry farming, consisting of a traditional farming sector and an intensive modern one, has experienced considerable growth over the past two decades. The poultry sector has a very significant economic weight in Moroccan agriculture with 23.3 million of days of labor and 9.9 billion dirhams in added value, offering 140,000 direct jobs and 320,000 indirect jobs.

The poultry sector contributes to more than a third of animal protein in the average food consumption of the Moroccan consumer. It currently covers 100% of poultry meat needs representing 52% of the total of all meats consumption combined. It also provides 100% of egg consumption requirements and generates a turnover of 27.4 billion Dirhams per year for an investment of 13.7 billion dirhams per year.

Poultry meat production in Morocco increased from 29,000 T in 1970 to 535,000 T in 2020, recording an average annual increase rate of 6%. At the same time, the production of eggs for consumption increased, rising from 400 million to 5.5 billion units, i.e. an average annual increase of 5.4%. The sector provides 100% coverage of the country’s needs in 2020.

Satisfying the ever-increasing demand (due to population growth, urbanization and the attractive price of poultry products) has essentially been achieved through the development of the intensive modern sector. Compared to 2008, total poultry meat production increased by 60% to reach 782,000 T in 2019; including 50,000 T from the traditional sector.

Table eggs production reached 6.9 billion units in 2019; an increase of 86% compared to 2008. Figures 1 and 2 represent the evolution of poultry meat and table egg productions at the national level.

Poultry production areas

In village farming, the poultry traditionally raised in Morocco is well distributed throughout the country with nevertheless geographical concentrations linked to the severity of the climate (North-South and West-East gradients) and to the demographic distribution.

Figure 3 shows the distribution of poultry farms at the national level, industrial farms are distinguished by a very high concentration on the Atlantic coast, particularly from Kenitra to El Jadida, offering a favorable climate and which is close to major consumption urban areas (Casablanca and Rabat).

Consumption

The traditional consumption model based essentially on cereals, sugars and fats is changing. Thus, the relative weight of these calorie-rich products decreases, and conversely, the share of protein-rich products (dairy products, eggs, meat, fish) increases.

Figures 4 and 5 show the consumption of poultry meat and eggs from 2000 to 2021, noting that the consumption of poultry products followed the same upward trend to stand in 2019 at 22.1 kg and 195 eggs per capita/year, respectively for poultry meat and eggs.

National production currently covers 100% of consumption egg needs and 100% of poultry meat needs; 48% of total meat consumption (all species).

Morocco is self-sufficient in white and red meat. Very few imported meat products are on the market. However, it can be seen that most of the inputs are imported, such as hatching eggs for the parent generations, poults, corn and soybeans, as well as equipment (cages, equipment for feed mills animals etc). The poultry sector generates however an important added value of livestock in the country, which has provided many jobs. Egg production is about 5 billion and it covers 100% of national demand.

Figures 6, 7 and 8 show the import/export of chicken eggs in shell, live hens and poultry meat between 2000 and 2020. The quantities imported are negligible, given the size of the Moroccan market.

Raising traditional Beldi chicken in Morocco

Over the years, several denominations have been granted to traditional poultry farming; farm, village, rural, traditional, indigenous and family chicken.

Traditional poultry farming is a type of farming practiced mainly in rural areas, under an extensive mode where each peasant family has a relatively small number of hens (Raveloson, 1990). Traditional poultry farming is an extensive farming method that includes an average of 5 to 20 chickens per family dispersed in small production units (Guèye, 2000).

In 2004, the FAO defined “rural poultry” as small-scale poultry production carried out by households using family labor and, as far as possible, locally available food supplies (Sonaiya and swan, 2004). Poultry can roam freely around the farm and forage for much of its food requirement, with the supplement provided by the farmer (Sonaiya, 1997). This definition was later clarified as “small herds, exploited by individual rural families for the purposes of food security, income, and gainful employment for women and children” (Sonaiya et al., 1999). Family poultry production is therefore distinct from medium to large scale commercial poultry production.

The animal material commonly used is the local breed or the hybrid chicken. Poultry is raised freely in the farm and rudimentary techniques are used. There is no specialization in production but apparently the animals are raised for their meat and eggs.

Traditional poultry farming remains widespread in rural areas. In Morocco, 50,000 tons of white meat and 800 million eggs produced come from traditional farms (FISA, 2020). Despite the decline in the proportion of traditional poultry livestock over the years, it has a significant weight in the formation of rural household income.

Traditional poultry farming is of great importance, particularly in socio-cultural, nutritional, economic terms, and in the fight against poverty in rural areas. In addition to generating income for the villagers, the “Beldi” chicken has symbolic importance in many social and religious ceremonies (Belkadi, 1968; Bachir, 2002; Alders 2005). In rural areas, more than two-thirds of

poultry meat raised is intended for home consumption, which reflects the important role of backyard farms in supplying this population with animal protein (Barkok, 2007).

According to the FAO (2013), Moroccan poultry is generally represented in the three referenced categories, namely at the level of the industrial sector, the commercial sector and in the backyard.

• Intensive systems: The Industrial and Integrated system is distinguished by a high level of biosecurity and birds/products sold in a commercial manner. Farms are part of an integrated operation system with standard biosecurity procedures manuals clearly defined and executed. These systems are practiced by medium to large companies.

• Semi-intensive systems: Commercial poultry system with a moderate to high level of biosecurity and birds/products usually sold in a commercial manner. Birds in the farms are kept permanently in confinement, rigorously preventing contact with other poultry or wildlife.

These are combinations of extensive and intensive systems in which the birds are confined to a specific space with access to shelter. They are commonly found in urban and peri-urban areas, but also in rural areas. In the park system, the birds are kept in a fenced area during the day and housed at night. Food and water are distributed inside to avoid waste and pollution by rain, wind and wild animals.

• Extensive backyard systems: Commercial poultry system with low to minimal level of biosecurity and birds sold at live poultry markets (e.g. a caged layer operation with birds in open housing; a farm with birds with access in the open air; a farm where chickens and waterfowl are raised).

Poultry are housed overnight and free to peck during the day. Morning and evening, a grain supplement is distributed to them. In Morocco, the majority of poultry units belong to the commercial sector according to the FAO classification.

METHODOLOGY

Various definitions were applied to the concept of the value chain. It is a strategic tool developed by Michael Porter in the 80s which makes it possible to determine how value is created within a company or organization. We can consider the value chain as a sequence of operations that begins with the supply of specific inputs to final consumption through production, processing and marketing. The development process of a value chain involves various actors (suppliers of specific inputs, producers, service providers, traders, etc.) whose role varies according to the links in the chain (Sidy Boly, 2019).

The analysis of the value chain is used to determine the specific activities that create value for firms and allow increasing their competitive advantages. The application of this process has two main advantages; in the first place, the identification of the main value-creating activities, secondly, the optimization of activities to increase the company’s margin and strengthen client value (Bockel and Tallec, 2005).

According to Tallec and Bockel (2005), the value chain incorporates a series of activities that ultimately add up to the total value created by a firm. The analysis of this chain aims to assess how each activity contributes (or not) to obtaining a competitive advantage.

Investigations

In our sample, 65 actors were interviewed including 30 points of sale, 32 producers (including 2 cooperatives) and three intermediaries distributed in different regions, weekly markets, villages and sale points. Four questionnaires were drawn up, a producer questionnaire, a sale point

questionnaire, a questionnaire intended for political and veterinary actors and a consumer questionnaire.

Data collection was carried out in 2 steps:

• Step 1: Before the field survey

This phase was based on the collection of bibliographic data and the preparation of the field. Indeed, data collection focused on documents, papers and research reports on the Beldi chicken sector.

• Step 2: Field work

Data collection in the field took place in different forms depending on the actor. Indeed, a questionnaire has been developed on the ODK Collect platform and which is intended for farmers, points of sales, veterinarians and politicians and finally consumers. The data is collected using the ODK Collect application. The authority officers (Mokadam and Cheikh) were asked to lead discussions with stakeholders including farmers and sale points. It is therefore essential for us to study the issue from a more in-depth angle through surveys of the various actors in the value chain using questionnaires adapted to each actor, as well as semi-structured interviews.

a) Mapping of the value chain

The purpose of mapping is to graphically represent the main actors as well as the operations and relationships between them. The main objective of preparing this framework is to give a visual representation of the actors in the chain and their interconnections. This allows to highlight all the actors involved in the Beldi chicken sector, to show the activities carried out in each link and, hence, to determine price transmission between the actors.

b) Functional and institutional analysis of the value chain

Constructing a “preliminary map” of a particular chain to provide an overview including the main functions at each stage, the agents performing these functions and the flow of the main products along the chain.

c) Profitability analysis

The cost analysis is based on the calculation of the cost price at each actor level on the basis of information collected from a reasoned sample of actors in the sector. This cost is used to determine the main actors’ income of the value chain.

Determinants of farmer income from Beldi chicken farming

After computing the income of farmers from the Beldi chicken farming activity, it seems important to identify the determinants of income from poultry farming using econometric analysis tools.

Choice of econometric analysis model

We seek through this econometric study to identify and analyze the variables that come into play in explaining the income of farmers from the farming of Beldi chicken. Indeed, the empirical approach implements a multiple regression model knowing that the dependent variable is a quantitative variable. This econometric analysis will allow apprehending the factors that influence directly the farmers income and explain how these factors are induced in the farming process.

That said, it should be mentioned that several constraints were encountered during the data

collection process. Most of these constraints are related to the lack of organization of the Beldi chicken sector; access to information: this is one of the most widespread constraints and which comes up in almost all research work, such as the non-availability of the latest statistics or the non-access to information from the institutions concerned. The investigation process does not escape from the reluctance of some actors to provide us with accurate information.

RESULTS AND DISCUSSION

In Morocco, the actors involved in the Beldi chicken sector were not clearly defined in the literature because of the lack of organization in this sector. According to the surveys carried out in the field, we generally recognize four actors in the Beldi chicken sector: producers, intermediaries, sale points and consumers.

Production

Egg production is highest in spring and summer, low in autumn and winter. Laying hens produce 22 to 26 eggs per month during hot periods and between 12 to 20 eggs in cold periods. The hen hatches between 12 and 18 eggs depending on her size.

According to our surveys, the farmers buy food from the weekly souks, they generally give wheat, corn, beans, oats, barley, bran, and leftover bread from home or purchased. This completes the spontaneous food formed by leaves, grasses, insects and earthworms. If food is available in sufficient quantity and quality, the production will be better in eggs, meat and feathers. For some farmers, the feeding of birds on the farm is spontaneous in the open air (Picture 1, 2).

During the study, we found the existence of some contagious diseases that require medication. Other diseases require curative treatments. Among the diseases observed, there are respiratory diseases, infectious bronchitis, laryngotracheitis, fowlpox, avian cholera, salmonellosis and coccidiosis. We noted the total absence of the intervention of veterinarians at farm level, the role of veterinarians is limited to the sale of drugs to farmers based on the symptoms mentioned by the poultry farmer. However, most interventions are carried out by the farmer using traditional medicines.

Functional and Institutional Analysis

The functional analysis aims to build a global description of the system that constitutes the value chain. It identifies and characterizes the main actors and stakeholders involved. It also informs about the main strategic development challenges of the value chain. It allows the multidisciplinary team to develop a common general understanding of the functioning of the value chain and to establish the field of analysis.

The functional analysis of the value chain of the Beldi chicken sector will allow us to describe the structure and functioning of the sector in order to identify the various actors involved, which will lead to a mapping of the chain by drawing up diagrams of flows crossing the actors between them with the physical quantities and the prices of the product. Thus, the construction of this scheme will highlight the chain of intermediaries and the places of transaction between production and consumption.

The poultry value chain is characterized by the presence of many stakeholders. The main links in this chain include: producers or farmers, intermediaries, sale points (traders) and consumers (Figure 9). Producers primarily maintain relationships with sellers of inputs and veterinary products in the upstream of the production chain. In the marketing of poultry products, there are two main actors: intermediaries and sale points. Sale points get their needs from the producers themselves or through intermediaries who collect the chicken from the producers. Farmers and

intermediaries supply other stakeholders such as traders and grocery stores that sell Beldi chicken eggs to end consumers as well as restaurants that offer Beldi chicken meals (Beldi chicken tagine, omelette, “Rfissa”…). Sometimes farmers sell directly to consumers in weekly markets. However, there are egg sellers who get their supplies from farms and intermediaries to resell them to the big markets, namely Casablanca, Khouribga. Veterinary products are purchased from local pharmacies or veterinarians to combat diseases.

The functional analysis of the Beldi chicken value chain makes it possible to identify the direct actors and those in support of the chain as well as their operations, to describe the different links.

Revenues and costs drawn by actor in the value chain

The costs per actor involved in the traditional poultry sector vary depending on the actor. The highest expenses were recorded among intermediaries (717 dhs per month) and the lowest (327 dhs per week) among farmers (Table 1). The costs relating to health recorded at the breeder level (2.10 dhs per week) are used over a production cycle. The analysis of these costs showed that the producers use respectively 64.0 % and 30.5 % of the costs in feeding and transport of the chickens.

The incomes of the different actors differ from the producers to the traders. The producers recorded the lowest monthly income (1 082 Dhs), while the intermediaries obtained the highest income (36 210 Dhs). Regarding these results, it is noted that the disproportion of incomes are at the origin of the lack of development of the traditional poultry sector. Indeed, annual incomes ranging between 1 434 dhs and 49 300 dhs have been recorded among farmers by selling more than half of their chickens. Despite the low income of producers (net income: 734 dhs per month), it plays an essential role in the creation of family income, especially for women, in meeting family needs especially in children education.

As for the margins, the producers obtained a margin of 33.7 dhs which is clearly higher than that of the other players. The high proportion of the producers’ margin can be justified by the low level of investment and expenses compared to other players in the sector, even if the time allowed to raise a chicken is significant. It is also higher compared to the margins obtained by traders and intermediaries ranging from 16.2 to 23.5 dhs.

The average prices for roosters and hens are respectively 50 and 100 dhs, between the prices applied in the villages (producers) and in the weekly markets. The lacks of price transparency linked to the difficulty of accessing information are parameters that cause prices to fluctuate from one place to another outside the standard factors. The prices at which consumers normally purchase are 50 dhs for the hen and 120 dhs for the rooster. During periods of high demand, the consumer buys hens on average at 75 dhs instead of 50 dhs in normal times. The price of roosters during this period can reach 160 dhs instead of 120 dhs.

Determinants of farmers’ income

The aim of this econometric study is to analyze the variables that could explain the farmer’s income formation from the farming activity of Beldi chicken. Indeed, the empirical approach implements a multiple regression model knowing that the dependent variable is a quantitative variable. The variables considered important to test their significance are presented in Table 2.

After several simulations of variables by the mixed selection method, the most accurate model for our analysis is a multiple linear regression model.

• Overall significance of the model

The Fisher global significance test is used to test the significance of all the coefficients of a model. The Fisher test assumptions are as follows:

H0: all the coefficients of the model are not significant

H1: There is at least one non-zero coefficient.

Fisher's p-critical = 4.23 e-11, so we reject H0. So there is at least one non-zero coefficient, i.e. there is at least one explanatory variable that has a significant effect on the dependent variable.

• Quality of the model

The coefficient of determination R2 of the model is 0,97. The model explains 97% of the variation in total income and therefore we can deduce that the model is very good.

• Significance of explanatory variables

Table 3 represents the individual significance of the variables introduced into the regression model.

The results show that the variable SVM (expenses attributed to the veterinary care of chickens) is highly significant in this model with a p-value less than 0.001. Moreover, the variable ALIM (Expenses attributed to the feeding) is also significant with a p-value less than 0.01 The variable GR and EXP are low significant at a level of 5%. The other variables are not significant.

The results of the multiple linear regression made it possible to highlight the expenditure attributed to health treatments, as an explanatory variable of the total income from the breeding of the Beldi chicken. The model is very good since 4 variables out of 9 explain the income formation.

Indeed, the expenses incurred for health treatments and feeding determine to which extent the farmers are aware of the basic needs of their animals. In addition, health treatment is a critical indicator for all farming in general and poultry farming in particular. This means that a healthy poultry population is less likely to have a high mortality rate, compared to poultry farms without health care. At the same time, the income is also dependent on the feed ratio distributed according to the declarations of the farmers. The feed ratio appears to be an important parameter in determining income, so that well-fed Beldi chickens are more productive than those left on the pasture without any feed supplementation.

The variables education and gender have a low significance on the income. The effect is negatively significant meaning that the increase of the number of years in school and female breeders has a low negative impact on the income which is not true in the most of empirical studies. However, the model did not show sufficient significance for other important variables like the experience and the size of the farm.

CONCLUSION

In Morocco, traditional Beldi chicken value chain lacks standardization. It is characterized by a high degree of informality and a reliance on traditional methods of production and distribution. However, there are efforts underway to formalize and modernize the sector through the development of processing facilities and the introduction of new distribution channels. The Beldi chicken sector in Morocco faces several challenges that hinder its growth and development. It is mainly composed of small-scale farmers who lack access to modern infrastructure and technology. These farmers often struggle to access funding, which can be a barrier to expanding their flocks or investing in new equipment. In addition, the Beldi chicken sector is characterized by a high degree of informality, which can make it difficult to track supply and demand and ensure fair pricing for all actors in the value chain. Addressing these challenges will require concerted efforts from stakeholders across the value chain, including government agencies, private sector actors, and development partners.

Other key interventions that could be beneficial for the development of this sector include investments in infrastructure, access to finance, and improved market linkages, as well as efforts to promote local labels, standardization and improve animal health and disease control measures.

AKNOWLEDGEMENTS

Financial support to the Scala Medi project has been provided by PRIMA, a program supported under H2020, the European Union's Framework Programme for Research and Innovation. SCALA-MEDI, Improving sustainability and quality of Sheep and Chicken production by leveraging the Adaptation potential of LocAl breeds in the MEDIterranean area, funded by the European Union's Horizon 2020 Partnership for Research and Innovation in the Mediterranean Area Programme (PRIMA) Grant 2012.

REFERENCES

Alders R. (2005). L'aviculture: source de profit et de plaisir. Volume 3 de FAO brochure sur la diversification. Organisation des Nations Unies pour l'alimentation et l'agriculture. Rome.

Bachir I. (2002). Socio-économie des élevages avicoles familiaux en zone périurbaine de Dakar (Sénégal). Mémoire Ingénieur agronome 2002 (ENSA).

Barkok A. (2007). Structure et importance des secteurs avicoles commercial et traditionnel au Maroc, FAO.

Belkadi M. (1968). L'aviculture au Maroc: Traditions- Aspect actuels- Perspectives. Thèse de Doctorat Vétérinaire, Ecole Nationale Vétérinaire de Lyon.

Bockel L., Tallec F. (2005). Commodity Chain Analysis Impact Analysis Using Shadow Prices. Agricultural Policy Support Service, Policy Assistance Division, Food and Agriculture Organization Of The United Nations, FAO Rome, Italie, décembre 2005.

Ekoue K. (2012). Interventions stratégiques pour l'aviculture familiale -Qu'est-ce qui peut être réalisé à travers des activités de recherche et de développement ?. -Rapport- conférence électronique RIDAF/ FAO/FIDA.

El Houadfi M. (1992). Rapport sur la production avicole et problèmes liés aux élevages traditionnels au Maroc. P 161 – 170 in: Séminaire sur l'épidémiologie et l'économie de la production avicole villageoise, Rabat, Maroc.

Fagrach A., Abdeladim R., Fellahi S., Bouslikhane M. (2021). Etude rétrospective des systèmes d'élevage et dominantes pathologiques du poulet traditionnels «beldi» au Maroc. Revue Marocaine des Sciences Agronomiques et Vétérinaires, 9: 370-376.

FAO (2013). Poultry development review. ISBN 978-92-5-108067-2. Retrieved from https://www.fao.org/3/i3531e/i3531e.pdf

FISA (2020). Fédération interprofessionnelle du secteur avicole. Secteur avicole. Documentation et statistiques.
https://www.fisamaroc.org.ma/index.php?option=com_content&view=article&id=17&Itemid=53

Guèye E. F. (2000). The role of family poultry in poverty alleviation, food security and the promotion of gender equality in rural Africa. Outlook on Agriculture, 29: 129-136.

Porter M.E., Kramer M.R. (2011). The big idea: Creating shared value. Harvard Business Review,

89: 2-17.

Raveloson C. (1990). Situation et contraintes de l'aviculture villageoise à Madagascar. In: CTA-Seminar Proceeding, Volume 2, Smallholder Rural Poultry Production, 9 - 13 October 1990, Thessaloniki, Greece, pp. 135-138.

Sidy B. (2019). Chaîne de valeur: Concepts et étapes de mise en œuvre. Séminaire National sur «La mesure de la contribution des services aux chaînes de valeur régionales». Nations Unies, CNUCED. Bamako.

Sonaiya E.B. (1997). Sustainable rural poultry production in Africa. In African Network for Rural Poultry Development, Progress Report, November 1989 to June 1995. Proceedings ANRPD Workshop, Addis Ababa, Ethiopia pp. 134-143.

Sonaiya E.B., Branckaert R D., Gueye E.F. (1999). Research and development options for family poultry. First International Network for Family Poultry Development/Food and Agriculture Organization of the United Nations Electronic Conference on Family Poultry, December 7, 1998–March 5, 1999.

Sonaiya E.B., Swan, S.E.J. (2004). Small-Scale Poultry Production, Technical Guide Manual. FAO Animal Production and Health, 1.

Sonaiya E.B., Swan, S.E.J. (2004). Production en Aviculture Familiale: Un Manuel Technique. Volume 1 de Manuel FAO de production et sante animales. Numéro 1 de Production et santé animales. Edited by FAO.

Tallec F., Bockel L. (2005). L'approche filière: analyse fonctionnelle. Document de formation et de la planification agricole, module n° 43. FAO, Rome, Italie.

References