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Dynamics of the Egg Supply Chain in the Southern Benin

Dolores I. Batonon[1,2], Frédéric Houndonougbo[2], Christophe A.A.M. Chrysostome [2], Guillaume Duteurtre[3], Denis Bastianelli[4], Philippe Lescoat[1,5]

[1]*INRA, UR083 Recherches avicoles, Nouzilly, F-37380 France*
[2]*UAC-FSA, Laboratoire de Recherches Avicoles et de Zoo-Economie, Abomey-Calavi, Bénin*
[3] *CIRAD, UMR SELMET, S/C Direction Régionale du CIRAD, 298 Kim Ma, Hanoi - Vietnam*
[4] *CIRAD, UMR SELMET, Baillarguet TA C-112/A, 34398 Montpellier cedex 05 - France*
[5]*AgroParisTech, Département Sciences de la Vie et Santé - UFR Développement des Filières Animales, 16, rue Claude Bernard, 75231 Paris, France*
dolores.batonon@gmail.com

ABSTRACT

A study on the Beninese egg supply chain was realized in order to understand its dynamics and to identify the factors that contributed to its evolution. A DPSIR model was used to analyze those dynamics. The method relied on identifying involved stakeholders on the studied territory, describing their specific functions and highlighting the driving forces which can contribute to the development of this chain. Eighty semi-structured individual interviews were led with different actors directly or indirectly involved in production, marketing and egg processing activities. The increase of the local demand and the ban on the imports of cooled eggs are some positive driving forces acted through grouping of stakeholders in unions. These drivers lead to the increase of the livestock breeding activities and the emergence of new stakeholders. However, the increase of the production resulted in a seasonal unavailability of some feedstuffs such as corn and soybeans, due to the weakness of the links between crops and poultry supply chains. Stakeholders in the egg chain must therefore adapt their strategies to the availability of feedstuffs and to the fluctuation of their prices in the country. Finally, development opportunities of the related supply chains were underlined such as: increase of the local production of corn and soybean and creation of frames to process and preserve eggs. These opportunities can generate new driving forces that would be more favorable to the development of the egg production.

1. INTRODUCTION

Beninese's poultry sector has been characterized by a recent increase of the egg production (FAO, 2013). However, according to FAO statistics, per capita egg and egg products consumption in Benin (1.20 Kg per year) is one of the lowest in the world (average of 8.90 Kg/year) (FAO, 2013). This low egg supply could be linked to the dependence and the vulnerability of local productions to the climatic conditions but also to the low competitiveness of the Beninese poultry supply chain compared to other African, Brazilian and European poultry chains. In particular, Beninese poultry chain is constrained by some difficulties in feed ingredients supplies and poor health controls (Onibon and Sodegla, 2006). Nevertheless, field studies show that there is a real potential for further development of this chain and diversification of its production. This could contribute to improving urban and rural diets through supplying low cost animal protein (TDH, 2010). In order to encourage innovation in laying hens farms, policy deciders and development agencies need to better understand the supply chain management mechanisms and its organization (Poccard-Chapuis *et al.*, 2011). In this context, a study was conducted to understand the dynamics of the Beninese egg supply chain and to identify the factors that contributed to its evolution.

2. MATERIALS AND METHODS

2.1 Studied area and stakeholders

The study was carried out in the Southern Benin in the districts of Atlantique, Littoral and Ouémé, where 75% of the poultry farmers and the main consumption markets are located. Some interviews were also realized in Borgou, an agricultural area of production of cereals in the Northern part. Based on diverse methods used to analyze animal chain in Europe, Brazil (Bonaudo *et al.*, 2011) and in West-Africa (Bastianelli, 2001; Djamen, 2008), semi-structured individual interviews and meetings were conducted with different groups of stakeholders, namely poultry farmers, animal feed manufacturers, wholesalers, consumers, etc..

2.2 Data collection

The data collection process combined two approaches: a study of the frame of the egg supply chain (Djamen, 2008) and an analysis of its dynamics (Poccard-Chapuis *et al.*, 2011).

First of all, to understand the Beninese poultry sector organization and its frame, the approach consisted in identifying the groups of stakeholders involved in the studied area but also in describing their specific functions. Two groups of stakeholders were distinguished: those involved in production, marketing, processing and consumption and indirect stakeholders, suppliers of services. A characterization of the flows implemented by each group of stakeholders and an identification of the strategies developed by these stakeholders were realized (Lossouarn, 1993). This phase was developed in collaboration with the National Union of Professional Poultry Farmers of Benin (UNAP-Benin) and consisted in semi-directed interviews realized with eighty individuals chosen with the advice of persons in charge of the professional organizations.

The second step of this study was based on the DPSIR model ("Driving Forces, Pressures, State, Impacts, Responses") (EEA, 1999) to understand the factors of changing, the driving forces and the different constraints that led to the development of the supply chain (Poccard-Chapuis *et al.*, 2011).

3. RESULTS AND DISCUSSION

3.1 Structure and organization of the egg supply chain

Beninese egg supply chain has recently experienced restructuring process in line with other West-African supply chains (Bastianelli, 2001; Duteurtre, 2008). In 2003, the unavailability and increasing costs of some feed ingredients and in 2006, the epidemic of avian flu compelled several stakeholders to improve their organization. The Livestock Institute of Benin, department of the Ministry of Agriculture, Livestock and Fisheries helped them to create professional organizations. These frameworks led to the creation in 2011 of an inter-professional union in poultry to coordinate actions in the supply chain and defend the interests of the members.

The material flows between stakeholders are shown figure 1. Supply in live animals is usually obtained from a supplier who imports hatching eggs from Europe (Belgium, Netherlands) or is obtained from providers of veterinary services who have an import business of day-old

chicks from Europe and other West African countries (Ivory Coast, Ghana, Nigeria). Large poultry farmers (> 3000 hens, representing 17% of the poultry farmers) import their day old chicks directly from the above-mentioned countries. Supply of 16 weeks-old ready-to-lay pullets appeared recently with layers' production by the biggest poultry farmer of the country for small laying hens' breeders. To produce laying hens' diets at low cost, 45% of the poultry farmers buy feed ingredients from the retailers and mix their diets in small artisanal unit. The others buy the diets from animal feed industries. Corn is the energy base of the diet and is mainly purchased from farmers in the North part of Benin. Corn prices fluctuate within the year (from 0,11€/Kg in October to 0,28€/Kg in June in the North of Benin) and from a geographical area to another one (from 0,11€/Kg in the North and 0,34€/Kg in the South during the harvest). Therefore, laying hens breeders' and animal feed manufacturers made adequate supplies during harvest whereas the small farmers remain dependent on price fluctuations on the market. Proteins are mainly provided by soybean meal, cottonseed meal and palm kernel meal produced locally. In addition, private companies and the Beninese Government import veterinary drugs and feed additives from several countries. Beninese Government exclusively distributes vaccines. Animal health technicians who have rarely license provide veterinary services. Finally, definition and implementation of national policy in agriculture go to the Ministry of Agriculture, Livestock and Fisheries, which sometimes leads interventions in the various projects through its decentralized departments in the communes and districts.

Main stakeholders of the supply chain are: laying hens' breeders, wholesalers, retailers, cafeterias, pastries and the consumers. The laying hens breeders are professionals from other supply chain who have consistent financial capacity and often use low-skilled workers to apply modern farming techniques used in Europe (Magdelaine *et al.*, 2011). They are provided in inputs and services from suppliers located mostly on the land and sell the products of the farm: eggs, hens, manure or litter to all or part of the stakeholders downstream. The marketing chain of eggs or hen's meat can be reduced to the direct sale to the consumers and/or to several intermediates. These latters are specialized (egg wholesalers, hens wholesaler) or carry several activities out the supply chain (pastries, coffee shops, retailers). Finally, hens are a meaningful source of income, are intended for human consumption and sold during religious holidays whereas the feces are sold to farmers in the study area.

3.2 Dynamics of the egg supply chain

A graphical representation of the factors and criteria describing the dynamics of the chain is provided Figure 2. As in many West African contexts (Poccard-Chapuis *et al.*, 2011), population growth is a major driving force for the development of the poultry supply chain. The current concern of these countries is to provide animal protein at a lower cost of ever increasing populations. The increase in urban population is another central driving force for dynamic of the activities in the study area. Between 2000 and 2012, 5% of the Beninese population moves from rural area towards urban areas and contributed to a change in food habits. Therefore, this movement created new land management ways (land rent, loan, purchase, etc.). In addition, the increase of incomes is one of the factors explaining the increase in demand of eggs and animal products (Rae and Nayga, 2010). According to FAO (2013), there is an increase in egg production between 2005 and 2010 (14,000 tons in 2010 against 7,000 tons in 2005) as well as in egg consumption (from 0.8 kg/capita/year in 2005 to 1.20 kg/capita/year in 2007). The other driving force of the development of the Beninese egg production was the ban on the imports of cooled eggs signed in 2005 between farmers, Livestock Institute and the main importers. The import of cooled eggs in Benin had resulted

in the closure of 13% of poultry farms because of the difficulties in selling their products (Onibon and Sodegla, 2006).

Pressures were generated on this system. The Government, through its various services elaborated development policies with the following mainlines: support or professional stakeholders, improving the legal and regulatory environment and land tenure (TDH, 2010). Contrary to some villages in Northern Benin where the inhabitants of this village use the land for agricultural activities, the South is facing significant pressure on land: the land is sold to the highest bidder. This situation tends to be worse with increasing urbanization. Despite the willingness of the Government to strengthen its role of regulating the whole poultry chain, stakeholders are facing the inter-seasonal variation in flows and prices of feed ingredients used in poultry feed. In fact, feed ingredients are illegally exported in Nigeria, which offers better prices.

Following these pressures, the supply chain experienced a process of restructuration; professional organizations were established. In spite of the actions of these unions and of the Government, building of poultry farms is not well controlled. Some farms formerly located in rural area are now in the urban area due to the pressures on land and to the urbanization. Moreover, links between crops and poultry supply chains are weak because of the competition between Nigeria and Benin. It leads to a seasonal unavailability of some feedstuffs such as corn and soybeans. Stakeholders in the egg chain have to be adapted to the availability of feedstuffs in the country with their abundance both in South and North. Another characteristic of this supply chain is the weakness of organization of the distribution of its products. The sale of eggs is very informal and is characterized by some periods of deficiency and other of overproduction. Large producers have a relationship of loyalty with their wholesale customers to whom they sell on credit in case of market saturation. Eggs are then sold to consumers on credit, or sold in Nigeria or thrown away during hot season, due to lack of processing and/or storage means. Producers with lower flocks sold their products on a local and close market. Another impact of the various driving forces and pressures above mentioned is the increase in poultry flocks in the study area and the geographic expansion of poultry farms which move close to other major cities, particularly in the North.

There are responses to these impacts. Firstly, to meet the high demand in inputs for poultry farms, there are new stakeholders specialized in live animals supplies, feed and importation of health products and feed additives. Farmers also adapt their technical management on the holidays where demand for meat is more important. Additionally, this supply chain presents some opportunities for development: the increase of the local production of corn and soybeans, the creation of companies for processing and storage of eggs and meat. Thus, the increase in livestock may be a new driving force. The interaction cycle supply chains/territories that was presented can evolve and induce new beneficial causalities for the poultry production.

3.3 Discussion

This study pointed out the organization and the dynamics of the Beninese egg supply chain. However, this study didn’t give more information about the feeding systems used in the laying hens farms. Understanding this supply chain is a starting point for understanding the efficiency of these feeding systems. Some answers may be made through a typology of farmers currently under study and an analysis of the performance obtained in connection with the feeding systems adopted (Bastianelli, 2001). Another issue is the competitiveness of this supply chain compared to the other supply chains in West Africa (Duteurtre, 2008). For a

better comprehension of the dynamics of stakeholders within the territory, it would be interesting not only to identify the most competitive players on the basis of challenges but also those who are most marginalized within the system. Moreover, according to Bonaudo *et al.*, (2011), there is a part of subjectivity in the DPSIR model. It would be interesting to establish the same models in each group of stakeholders; knowing that the challenges could depend on each group of stakeholders (Djamen, 2008). The DPSIR model also allows studying the poultry supply chain in relation to other agricultural activities in the territory (Bonaudo *et al.*, 2011) but this component was not studied. An analysis of the spatial evolution of the egg production (Poccard-Chapuis *et al.*, 2007) would have been an asset in this study, thus showing the mechanisms of territorial adaptation egg supply chain.

The Beninese egg supply chain is expanding and there are several stakeholders in relationship in the study area. The application of the DPSIR model identified levers of development of the supply chain as feeding systems, day old chicks' supplies and control of distribution channels for products. The prospects of this work are oriented on laying hens feeding as a key of the sustainability and the development of the supply chain. Thus, to assess the feasibility of alternative feeding systems, a study of the performances obtained in laying hens farms will be implemented according to the technical managements realized by the farmers.

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Figure 1. Organization of the egg supply chain in Southern Benin showing the material flows between stakeholders upstream and those downstream, inside or not the study area

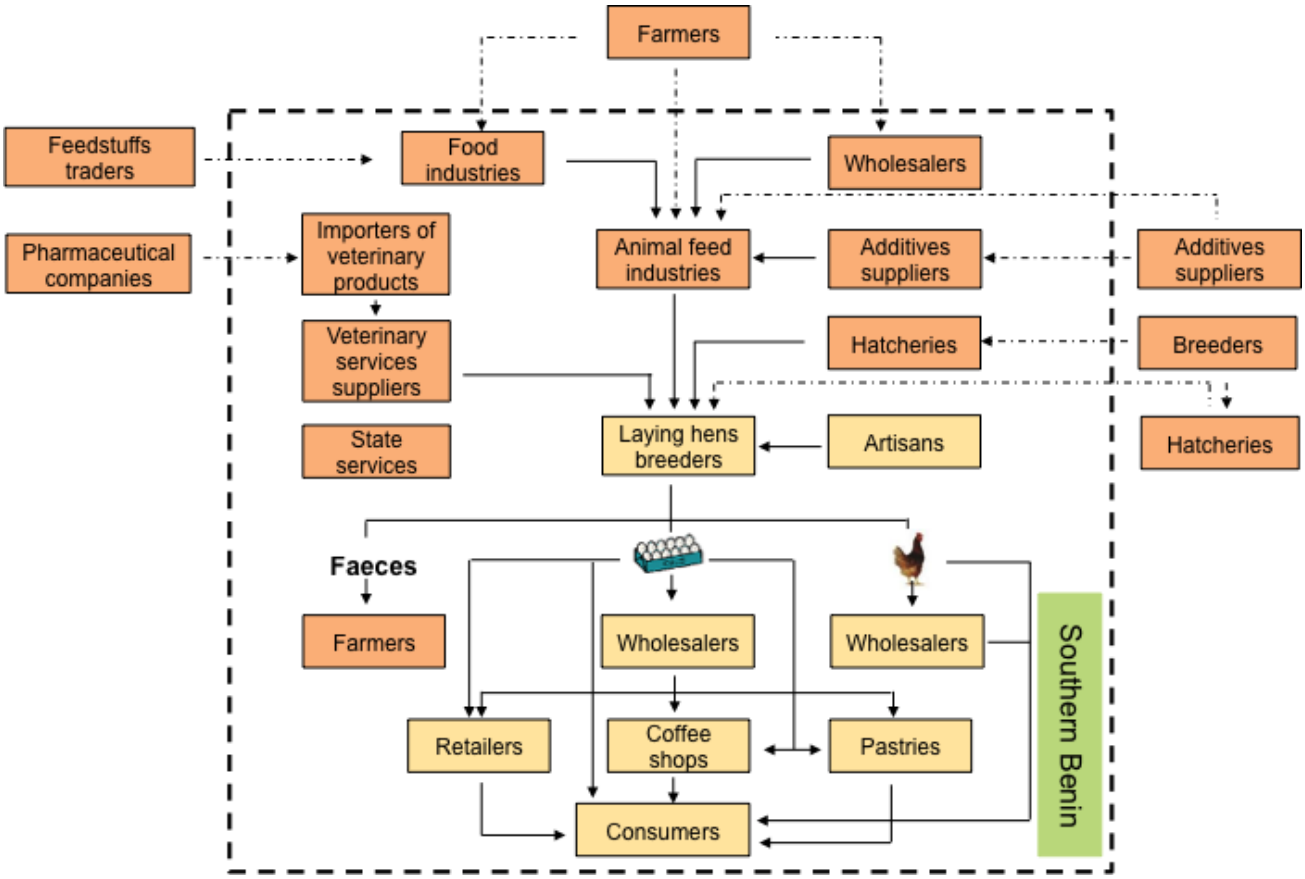
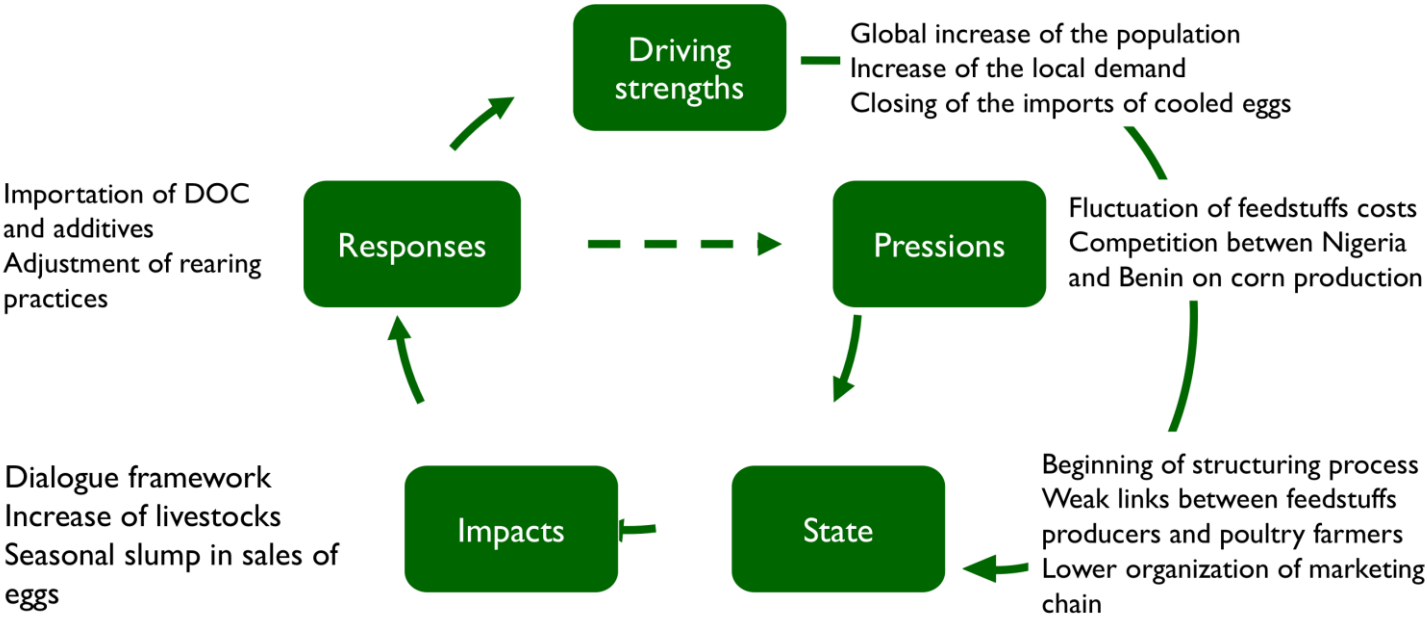
Figure 2. Factors explaining the dynamics of the Beninese egg supply chain