

# **Technological Changes for the competitiveness of the pig value chain in Côte d'Ivoire**

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## **1. Introduction**

After twenty years of crisis due to the African swine fever that occurred in 1996, the Ivorian pig industry is trying to find its benchmarks. In this context, several initiatives have been or are being implemented in Côte d'Ivoire as the detailed program of African Agriculture Development (CAADP).

In this article, we explore how the technological changes could strengthen the competitiveness of the Ivorian pig value chain. A structuring element of this agricultural value chain based on technology transfer from the European Union. We bear for it a study crossed between the Ivorian sector and the Brittany sector (which represents 60% of the French pig production).

We wonder also, in view of a national population growth (3.3% / year), how the Ivorian food market will be able to create opportunities for other technology in order to increase the overall food supply to satisfy national demand in protein consumption ?

The objective of this study was to analyze the socio-technological changes which structure different adaptation trajectories in the pig value chain to macroeconomic issues and more especially to food security issues and social welfare in Côte d'Ivoire, in reference to swine industry in Brittany.

This study identifying productive investment and innovation processes contributing to a reduction of the rate of food insecurity, malnutrition, poverty, unemployment, etc. It also test the adaptation trajectories mobilize resources locally produced to increase the competitiveness of the Ivorian pig industry.

## **2. Conceptual and methodological framework**

### **2.1. Application of theoretical AND Empirical analysis**

This article questions the development economy (Baldwin, 1975) and economy of innovation (Guellec, 1999 ; Le Bas, 2014) in the analysis of relations between the development of domestic markets related to food and agricultural production, and the technology transitions (). It carries a special focus on structuring the research hypothesis about the role and contribution of gender (male / female, age, etc.) in technological adaptations to food security issues and economic development (Lancon, 1989; Chaléard, 1996; Kouba & Mourot, 2011; Dury & Bocoum, 2012; Laidin, 2013; Dabat et al., 2015). The interface between economy and animal science is contextualized to the case of the pig industry. It analyzes how the analytic framework of an SSI allows to look pig sectors of Côte d'Ivoire and France, from the viewpoint of technology transfer and their relation with food security in Côte d'Ivoire.

Two surveys conducted with thirty contacts in Côte d'Ivoire and fifteen in France, in research institutions and leaderships, ministries, cooperatives, markets, communities, feed producers, private firms of food, breeders, multipliers, producers, processors, traders and consumers, structure our results. In Côte d'Ivoire, it was to identify the limiting factors which hinder the achievement of food security in pig meat, based on the French model. There was also a collection of secondary data in Côte d'Ivoire that concerned some departments in charge of agriculture in food production and food security, and those of animal and fisheries resources, Inter professional Fund for Agricultural Research and Consulting.

## 2.2. Analytical framework

The method was first to mobilize a review of the literature on French and Ivorian pig sectors, and then approaches of the question in terms of the innovation system. Thus, it referencing is relevant conceptual and methodological frameworks mobilizing two complementary standards. A theoretical reference concerning innovation systems (Touzard et al., 2014; Temple et al., 2015) and more especially the sectoral systems of innovation (Malerba, 2002; Laperche, 2014).

A more methodological referential on analytical frameworks of value chains (Gereffi et al., 2005; Gibbon & Ponte, 2005; Palpacuer et al., 2005) and commodity chain analysis (Hugon, 1990; Temple et al., 2011). These approaches would allow to study the trajectories of the genetic selection of paths, multiplication, production, processing, marketing and consumption of pork meat since the crisis in the Sahel (1972).

The mobilization of a repository "innovation system" is indeed useful for analyzing innovation policies (and research) currently in Côte d'Ivoire. This methodology will also help to know: how an innovation model based on the development of local resources (by-products of agriculture, ...) and / or a model that involves technology transfers based on external resources (knowledge, skills) generate development which realizes the competitiveness of the sector on the one hand, and how to fit together (hybrid) these innovation models (complementary-concurrent-coopetition) in their impact on the inclusion of women in this model, on the other?

The repository sectoral system of innovation and production (SSIP) of Malerba (2002) mobilized lead us methodologically to the following activities:

- i) Identify the components of SSIP on every aspect of the pig industry;
- ii) Analyze the interactions of these components;
- iii) Analyze the systemic dimension of innovation;
- iv) Analyze the interfaces with the structuring innovation areas (national, regional, sectoral);
- v) Review the policies for research and innovation in achieving food security;
- vi) Assess the consistency of these policies in the inclusion of women entrepreneurs.

The ATLAS 3.4 software was used for the treatment of "guides or grids" of qualitative interviews. The analysis of data collected using questionnaires was made possible through software Sphinx 2, and Microsoft Excel 2013 and Wamp Server 2.5. The inventory and characterization of the study area and actors was mainly realized by descriptive statistics tools. The statistical methods used for analysis of the collected data were summarized by: the comparison of averages, variance analysis and adjustment tests, all made from STATA 12. Crosses of information from the documentary research, various surveys and observations were also used to make situational analysis to propose corrective actions and to make recommendations sorted by priority matrix of activities. The analysis of the competitiveness of the production-slaughter will be addressed through the study of SSIP.

### 3. Methodological framework

The data collected are funded on a "social analysis grid" based on "gender approach". Thus, the information sought by France and Côte d'Ivoire concerned the practices, knowledge, methods of supply and marketing of actors to identify the contribution (or not) of women in the various links in the value chain and innovations that they develop, too. These data have been obtained through primary and secondary collecting. These data were firstly qualitative for actors not manipulating products (surveys on expert knowledge) and quantitative, to those directly working in each analyzed link in pig industry.

#### 3.1. Secondary data collections

All the secondary data collections were made using guides and grids of semi-structured interviews. These surveys were conducted either visually or by phone, both in Côte d'Ivoire and in Brittany, in April and June 2015.

#### 3.2. Primary data collections

Subsequently, a field survey was carried out in both countries, with actors in direct contact with the product (producers, processors, traders and consumers). The primary data collection (from the face-to-face) made in the field has been made possible through open-ended questionnaires, semi-open and closed ones for individual interviews and guides for focus groups in September 2015 and July at August 2016. A total of thirty actors were interviewed by category. (Table 1)

In this article, we discuss the link between production and slaughter in the Ivorian food chain.

**Table 1. Data collections**

Structures	Research Methods				INFORMATIONS GATHERED
	Focus group discussion	Semi-structured interviews	Interviews	Unstructured	
<b>MIRAH</b> (Livestock Ministry)	1	1		1	- Background of pig sector; pig production, retail - Partnership WAAPP to reduce food dependency - Perception of role of the INTERPORCI (IP)
<b>FIRCA</b> (Executing WAAPP-CI)	1	1		1	- History of choice and introduction of improved race: Land Race, Large White, Piétrain and Duroc - Functioning of the agricultural innovation system
<b>ANADER</b> (Agricultural advisor)		4		1	- Interacting professionals and research institutions - Identifying of package of pig technology transfer - Perception of the role of the INTERPORCI
<b>CNRA</b> <b>SIVAC</b> <b>BNETD</b>	1 (BNETD)	3	3	1 (SIVAC)	- Service provided and production issues - Origin of pig in Genetic Improvement Center - Information on links with WAAPP projects - Collaboration with ANADER and MIRAH
<b>INTERPORCI</b> (IP)	1	1	2		- Identifying IP members own networks and the way they were organized before the inception - Identifying the role of the member within the IP

## 4. Empirical Results

In Côte d'Ivoire (as it is the case for sub-saharian African countries), more than 70% of the agriculture and agri-food industry belongs to companies from the informal sector. Nowadays, each year, the Côte d'Ivoire still imports more than 100 000 T (carcass weight equivalent) of pig meat and offals (Coulibaly, 2013), in order to meet the national demand of animal proteins. Our first results show a real lack of synergy between the diverse programs and projects of development carried out in the different structures in charge of the Ivorian pig value chain.

### 4.1. Multiplicity of programs to improve prolificacy pig breeds

Several institutional changes (norms and standards) seem to be implemented in order to build the harmonization of the different public politics of development in order to reduce deficit of the animal value chain. The common goal of these institutions is to develop mechanisms for increase gilt prolificacy and improve the pork quality. But these strategies still remain "secret sites" for the majority of producers in the chain.

These projects are accommodated within different structures charged of the development and implementation of livestock development strategies. These include the Ministry in charge of Animal and Fishery Resources (MIRAH), the Interprofessional Fund for Agricultural Research and the Council (FIRCA), the National Agricultural Research Center (CNRA), the National office of Technical Studies Development (BNETD), the National Polytechnic Institute Felix Houphouet Boigny (INPHB), the National School of Statistics and Applied Economics (ENSEA), the Ivorian Company of Slaughter and Charcuterie (SIVAC), the National Agency for Rural Development (ANADER), the Côte d'Ivoire swine Interprofession (InterPorci), the Professional Breeding Organizations (OPE), the Cooperative Grace Divine of women trader for pig meat, the meat processing company in pigs meat and meat curing (SICS, GID, SAFAL, etc.).

It is in this context that a Genetic Improvement Center (CAG) for the renewal of the local pig breeds (by French breeds) was built by the CNRA with support from the West Africa Agricultural Productivity Program (WAAPP) initiated by the Economic Community of West African States (ECOWAS) and the financial support of the World Bank. These programs concern in particular the generation and / or transfer of technological innovations (pure breeds of animals and hybrid varieties of plants) and their distribution to people and target groups in the agricultural and food sectors in the sub-region. Thus, the creation of the CAG aims to improve prolificacy of local and imported gilts respectively to decrease the consanguinity and reach a minimum of 8 piglets per gilt (FIRCA, 2015). One of its objectives is to increase the growth rate of pigs.

However, the performance increase will not be reached without adapted feed. So for this purpose, research projects on the use of Ivorian products in animal feed carried out in the INPHB have been funded by the FIRCA for two years. A study carried out in order to analyze the effect of detoxified rubber tree cake meal (*Hevea brasiliensis*), elegated cashew nuts (*Anacardium occidentale*) or *Jatropha* nuts (*Jatropha curcas*) on pig performance and the pork nutritional quality (Koné et al., 2016, in press). All these products are locally produced and therefore are easy to use without a competition with Ivorian population food.

There are also innovative initiatives such as (i) the creation of the Ivorian swine Inter-profession (InterPorci) in 2011 and (ii) the establishment in Yamoussoukro as in Abidjan, of controllers of MIRAHA in charge of veterinary inspection of slaughter on the farm realize by the producer himself, more and more frequent, this in order to contribute to the competitiveness of the sector, reducing the producer transport costs.

#### **4.2. Socio-technological Changes in Pig value chain**

Our study also highlights two types of socio-technological trajectories in this value chain. One is based on a linear conception of innovation using industrial inputs (food commodities), while the other (multidimensional) advocates the use of local resources as a prerequisite for the competitiveness of this sector. These local resources are mostly made by the household peelings, spent grain corn, kitchen scraps and more recently food formulations using agricultural by-products (physic nut, cashew and rubber) to come to the substitution of imported raw materials such as soybean meal.

According to SIVAC and Ministry (MIRAHA), the cost of food represents more than 70% of the production costs of one kg of pork in Côte d'Ivoire. The high cost of imported raw materials leads indeed farmers to use rations that do not cover the needs of the animals. Thus, in Côte d'Ivoire, it takes up to 13 months to get a pig weighing 70 kg in traditional and semi-modern system, when in France, with the same race, we get a pork weighing 110 kg at 5,5 months. To have a competitive product it is appropriate to reduce the cost of use for the production of this pig.

The presence of these more producer groups has revitalized the pig value chain and promotes exchanges between the actors of the production. Investigations have however revealed significant changes in these associations and particularly their progress towards forms of cooperative societies, which results in a decline in producer group number in the sector. These groups are organized in several umbrella or OPE represented in all major regions of pork production such as (i) at Bingerville we note particularly the presence of the UNEGABY, those of the APPORCI at Abidjan (and also this periphery), the CEPOM in region of Man, the CEPOMA in the Bouaflé region's, the FEPPORC in Bouaké town, the SCOOP-HS of Daloa area and the OPE of the FEDEPKO in Korhogo town.

The creation of the Interporci in 2011 is a breath of fresh air in the coordination of all categories of stakeholders and in the restructuring of the pig value chain. This interprofessional includes indeed the OPE, processors (traditional and modern), traders, research centers (CNRA), training (ANADER and INADES Training), public universities, etc. Interporci advocates for pricing per kg of pork established since 2012 at 1 250 CFA by all direct stakeholders of the value chain. However, the price of pork per kilogram for the producer may reach up to 1 500 F CFA, depending on the period (parties or ordinary days) and the feed the animals receive.

#### **4.3. Diagnostics of the production system and consanguinity pig races**

The diagnosis of this value chain reveals four production systems in Côte d'Ivoire. The first but not the most dominant is the system without straying production plan and without sanitary control, with animals in total freedom. A second traditional qualified system is characterized by wooden buildings, bamboo or land. The semi-modern system

represents the third type with buildings made of brick, wire mesh and tarpaulin, often unfinished. It is the most widespread system. The modern system corresponding to a type of building hard with sheets, facing north. These production systems are identifiable in North (Korhogo) to South (Bingerville) in this country and around of the Abidjan.

The study also highlights the weight of inbreeding rampant in local races in farms (mostly held by men) that result from the replenishment of livestock following the swine fever (ASF) in 1996 that reduced considerably the number of livestock throughout the territory. Also in 2014, an outbreak of ASF has also been identified in San Pedro. This was quickly circumscribed thanks to initiatives taken by InterPorci, veterinarians and officials of public services, all in a spirit of solidarity, mutual help and understanding of producers and indirect stakeholders in the sector including FIRCA, MIRAH, key players directly linked to the transformation, in this case the SCIS Company that owned the largest herd of pig farms.

In addition, there is only one official national abattoir located mainly in Abidjan, making difficult and expensive animal transport from the farms to this capital. This results in a significant number of illegal slaughters that escape any veterinarian control and are usually carried out with a total lack of hygiene. According to unofficial sources, there would be as much or maybe more pigs slaughtered clandestinely than pigs slaughtered at the abattoir of SIVAC and in controlled farms. Thus, the construction of slaughterhouses in major cities, the identification of producers and a better awareness of the harmful consequences of these medieval practices, could be an effective way to fight against these illegal slaughters, and would gain competitiveness in the Ivorian pig industry in the context of food security achieved.

## **5. Conclusion**

The problem of food security and improvement of the living conditions is taken into account in economic development prospects and is actually materialized through national programs / projects (CAADP). However the Côte d'Ivoire needs to take a true view of the challenges in order to propose and finance research policy and innovation that responds to the need of structuring a sectoral system of innovation able to contribute to food security issues with greater inclusion of women in the processes of technological changes in progress.

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