

An analysis of the broiler value chain and economics of broiler production in Senegal: status quo after two decades of import restrictions

Broiler
production in
Senegal

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Abstract

Purpose – This study analyzed the state of broiler production in Senegal after nearly two decades of poultry import restrictions. It provides a synopsis of the Senegalese broiler value chain and evaluates the performance and economics of different broiler farm types.

Design/methodology/approach – A multi-stakeholder workshop and interviews were conducted with key informants to investigate the structure and activities of the Senegalese broiler value chain. The typical farm approach (TFA) was used to construct and analyze “typical” farms that represent the most common broiler production systems in Senegal.

Findings – The current situation in the Senegalese broiler value chain is favorable for hatcheries, feed mills, producers and poultry traders. However, the slaughterhouses are not faring well. The farm economic analysis demonstrates that typical medium-scale broiler farms are performing well, due to the use of high-quality feed, chicks and good husbandry. Additionally, the analysis revealed that feed and day-old chick (DOC) costs are the most significant in conventional broiler production in Senegal. Despite the high costs of feed and DOCs, broiler production is profitable for typical farms.

Research limitations/implications – Although this study provides detailed insights into broiler farm economics in Senegal, it does not include typical integrated large-scale broiler farm-types. Based on our findings, we can predict that such farm types may be more efficient and have lower production costs due to the use of high-quality inputs (chicks and feed), and economies of scale. However, future studies will need to verify this prediction.

Originality/value – To the best of the authors’ knowledge, only a few unpublished studies on broiler farm economics in Senegal exist. These studies only provide a basic analysis of the cost of production and

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1. Introduction

In the late 1990s, several West African countries experienced a trade liberalization era, which led to a significant reduction in trade barriers (Kargbo, 2005; Rakotoarisoa *et al.*, 2011). Consequently, countries experienced surges in agricultural imports, particularly dairy and poultry products (FAO, 2005). In addition, demand for agricultural imports was driven by rapid urbanization, an emerging middle class and higher income (Kabasa *et al.*, 2015). Poultry imports were predominantly frozen chicken cuts, which were much cheaper than domestically produced chicken meat. Chicken imports became a contentious issue, as locally produced chicken meat could not compete with them (FAO, 2005; Johnson, 2011). Furthermore, low-cost imports are believed to have resulted in farm closures, loss of income and a sharp decline in domestic poultry production in West African countries, such as Ghana, Senegal and the Ivory Coast (Johnson, 2011; Odijie, 2020).

Several countries have implemented measures in response to competition from low-cost imports. For instance, in 2002, Nigeria imposed a ban on poultry meat imports to protect the domestic poultry sector (Heise *et al.*, 2015). In 2005, the Ivory Coast imposed an import tax of FCFA 1000/kg (US\$2/kg) on poultry meat imports, resulting in a significant decrease in poultry imports (Odijie, 2020). In the same year, the Senegalese government banned all imports of uncooked poultry meat to protect the country against an avian influenza (AI) outbreak (Boimah and Weible, 2021; Johnson, 2011). However, some are of the opinion that Senegal may have imposed the ban, to a larger extent, to protect its broiler sector from cheap imports than to prevent AI outbreaks (Ngom *et al.*, 2015).

Poultry import bans are a common response to AI outbreaks (Wieck *et al.*, 2012). For example, in 2006 and 2020, the Ghanaian government imposed partial poultry import bans due to AI outbreaks (Zamani *et al.*, 2022). However, the case of Senegal is particularly interesting because, unlike Ghana, which had partial and temporary bans on poultry imports due to AI, the ban in Senegal is complete and has been in place for almost 20 years. This means that not only does the ban protect the poultry sector from AI but also protects the broiler value chain from competition from low-cost frozen chicken imports.

Broiler producers in Senegal are often touted as the largest beneficiaries of the ban policy (Arnoldus *et al.*, 2021; Johnson, 2011). However, to the best of our knowledge, the existing literature does not provide a comprehensive analysis of the state of broiler production in Senegal, which is required to confirm these claims (i.e. farm performance, costs of production and profitability of different broiler farm types). Existing studies, which are mostly Masters' theses, on broiler farm economic analysis (Lo, 2009; Ossebi, 2011) only provide a basic analysis of the cost of production and profitability, with little consideration of the various conventional broiler production systems. In this context, this study aims to provide a detailed farm economic analysis of different conventional broiler farm types in key production regions following two decades of import restrictions. More specifically, it evaluates the farm performance, production costs and profitability of small and medium conventional broiler farm-types "typical farms" in two of the most important production regions (Dakar and Thiès). To better understand the economic status of broiler farm economics under imported restrictions, this study first analyzes the current state of the Senegalese broiler value chain. Therefore, this study contributes to the literature in two ways: (1) it offers a synopsis of the organization and activities of the Senegalese broiler value chain; and (2) provides an in-depth analysis of conventional broiler farm economics.

This paper is organized into six sections. Section 2 explores the evolution of the Senegalese poultry meat sector. Section 3 describes the research methodology used in this study. Section 4 presents the findings, and Section 5 discusses them. Finally, Section 6 presents conclusions and recommendations.

2. Overview of the evolution of the Senegalese poultry meat sector

According to Boimah and Weible (2021) and FAO (2005), the Senegalese economy gradually liberalized trade after the country adopted the common external tariff (CET) and West African Monetary and Economic Union (WAEMU) tariff structures. FAO (2005) explains that before 1998, the applied tariff on chicken cuts (e.g. thighs and wings) was 55%, but it was gradually reduced to 30%, 25% and 20% in 1999, 2000 and 2002, respectively. However, in 2006, there was a complete change in policy as the government banned all imports of uncooked poultry meat to prevent an AI outbreak. AI outbreaks can have devastating effects on poultry producers and the wider economy, as proven by experiences from different countries. For example, Ghana spent approximately US\$ 4.3 million on the control and containment of an AI outbreak during the same period that Senegal banned all imports. Approximately 40,727 chickens from 35 Ghanaian farms died or were culled due to AI (Akunzule *et al.*, 2009). As well as infecting birds, AI can infect humans, posing a persistent risk to public health (Li *et al.*, 2019). Members of the World Trade Organization (WTO), including Senegal, cannot impose import bans under normal circumstances. However, a member country can place a ban on imports if they have the potential to cause harm to humans, animals, or plants such as the case of Avian influenza outbreaks (Ngom *et al.*, 2015). However, the Senegalese government continues to permit the importation of live birds in the form of day-old chicks (DOCs). Figure 1 shows that DOC imports rose sharply during periods of booming poultry meat production (such as in 2011 and 2016).

Figure 1 shows that prior to the poultry meat import ban, poultry meat consumption rapidly increased from the year 2000–2005. This increase in consumption was supported by

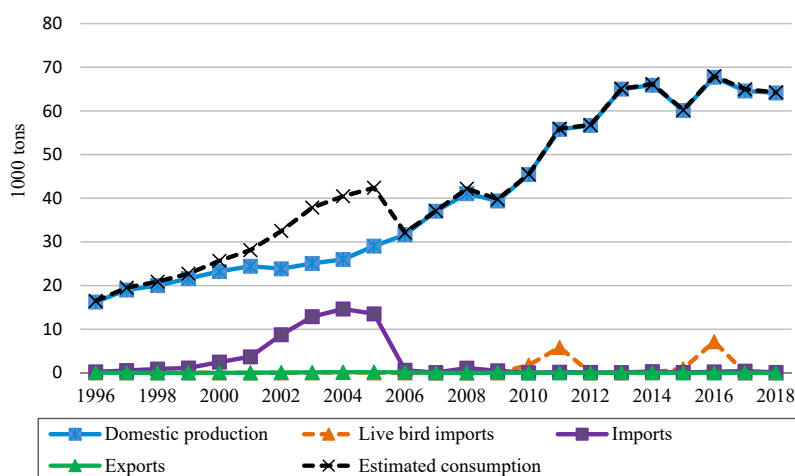


Figure 1. Evolution of the senegalese poultry meat sector (1996–2018)

Note(s): The domestic consumption is estimated based on imports + production - exports. Exports and imports are based on UN Comtrade (2018), HS code: 0207. Production data are retrieved from FAOSTAT

Source(s): Zamani *et al.* (2021)

an increase in poultry imports and a gradual increase in domestic production. Johnson (2011) explains that there was a sharp increase in frozen chicken meat imports because they were more affordable than domestically produced chicken meat and were available in cut pieces that were convenient to cook. Most poultry imports were frozen chicken pieces (cuts) from Europe and Brazil (Boimah and Weible, 2021). Just before the ban in 2005, imports accounted for approximately 32% of the total poultry meat supply (Figure 1). In 2006, there was a sharp decline in consumption following the ban on poultry meat imports. However, shortly thereafter (2006–2007), domestic production rose sharply, leading to an increase in consumption. According to Zamani *et al.* (2020), during the period 2006–2018, domestic production increased by 102%. Consequently, Zamani *et al.* (2020) estimate that the per capita consumption of poultry meat increased from approximately 1.8 kg in 1996 to 4.1 kg in 2018. However, in 2020, there was a sharp decline in the consumption of poultry meat due to the COVID-19 pandemic. Ly (2020) explains that COVID-19 restrictions resulted in the closure of restaurants, hotels and takeaways, which significantly reduced the consumption of chicken.

3. Data and methods

3.1 Value chain analysis

The main aim of value chain analysis is to provide a description of the state of the Senegalese broiler value chain. The value chain was studied through a two-step qualitative research process. The first step of the process entailed obtaining broad data about the value chain through a multi-stakeholder workshop. More specifically, the multi-stakeholder workshop was used for engaging value chain actors to map the value chain and identify the key activities in the value chain. The second step in the research process entailed going deeper into the issues raised by the participants of the multi-stakeholder workshop through the use of key informant interviews. Semi-structured interviews with value chain actors (key informants) were conducted to gain in-depth information about the actors' activities and how they are interconnected. A total of 64 actors participated in the multi-stakeholder workshop and key informant interviews.

3.1.1 Multi-stakeholder workshop. According to Ørngreen and Levinsen (2017), a multi-stakeholder workshop can be employed as a qualitative research method for gathering data or validating results. In this context, a multi-stakeholder workshop was organized on February 24, 2020 in Dakar, Senegal to gather information, opinions and experiences on poultry and dairy production in Senegal. The workshop brought together 45 participants, including producers (small-, medium- and large-scale), civil society, processors, international organizations, researchers and processors. The multi-stakeholder discussions were held through four break-out groups, each comprised eight participants and two researchers. The researchers facilitated the group discussions and took notes. A qualitative content analysis was then used to analyze the notes gathered from the break-out groups.

3.1.2 Key informant interviews. Key informant interviews were conducted to better understand issues in the Senegalese broiler value chain which are relevant for the interpretation of the results of the farm economic analysis. Semi-structured interviews were used to collect data from 19 key informants knowledgeable about different activities and issues in the Senegalese broiler value chain. The interviews were used to compliment the multi-stakeholder workshop and explored in detail the issues that were raised in the workshop. The interviews were conducted between February 17, 2021 and March 31, 2021, in Dakar and Thiès; Dakar is the capital of Senegal and Thiès is the third-largest city in Senegal. Each interview lasted for approximately 60 min. Table 1 shows the key informants; input suppliers (hatchery operators and feed manufacturers), broiler producers, poultry traders (commonly referred to as *bana-banas*), processors and retailers. The broiler producers that were interviewed included two small-scale producers, three medium-scale producers and three large-scale producers. Convenience sampling was used to select key informants. This non-probability sampling method is

commonly used in value chain analysis, as it allows researchers to select relevant interviewees according to their accessibility and knowledge regarding the value chain (De Beuckelaer and Wagner, 2012). Field notes were taken during the interviews and later analyzed using qualitative content analysis. MAXQDA, a qualitative data analysis software (QDAS), which offers several tools for qualitative data analysis, was used for the content analysis.

3.2 Broiler farm economic analysis

3.2.1 Typical farm approach (TFA). The typical farm approach (TFA) was used to construct and analyze “virtual” farms that represent the most common broiler production systems in Senegal. This approach uses individual farm data, national statistics and expert consultations to construct virtual farms called “typical farms” (Chibanda *et al.*, 2022; Kress and Verhaagh, 2019; Lasner *et al.*, 2020; Ndambi and Hemme, 2009; Siqueira and Duru, 2016). This study applies TFA through a series of steps explained in detail in Chibanda *et al.* (2020) and Chibanda *et al.* (2022). The steps are summarized as follows.

Step 1 and 2. The most common broiler production systems and the most important broiler production regions in Senegal were identified through a review of literature and national statistics, and through consulting local experts. Small-, medium- and large-scale integrated production systems were identified as the most common conventional broiler production systems. Dakar and Thiès were identified as the most important broiler production regions.

Step 3. Data collection: Due to limited national data on broiler farms in Senegal, broiler farms with characteristics representing small- and medium-scale production systems were selected in consultation with extension officers, veterinary officers and local researchers. A large-scale integrated broiler farm was not selected because during the data collection period (January 2022), due to suspected cases of the highly pathogenic H5N1 bird flu in Senegal [1], large-scale farms had prohibited farm visits. Hence, instead of selecting a large-scale farm for individual farm data collection, two medium-scale farms with slightly different characteristics from different regions (Dakar and Thiès) were selected. We visited the selected farms and used a standard questionnaire to collect data from the producers through semi-structured interviews. The collected individual farm data was then “typified.” Chibanda *et al.* (2020) explain that the process of typifying individual farm data entailed replacing figures that represent particularities of the individual farm with figures that are more common for the production system in a specific region. Chibanda *et al.* (2020) further explain that the typification of individual farm data can be done through either focus groups or by consulting poultry experts. In this study, individual farm data were typified by poultry experts (agricultural officers and researchers) knowledgeable of the production systems and regions who reviewed figures provided by the individual farmers.

Step 4: Data analysis and cross-checking: The technology impact policy impact calculations (TIPI-CAL) model was used to analyze the typical farm data. Similar to Chibanda

Type of key informants	No. Interviewed
Hatchery managers	2
Commercial feed mill managers	2
Broiler producers	8
Poultry traders (Bana-banas)	2
Slaughterhouse managers	2
Retail managers	3
Total	19

Source(s): Own elaboration

Table 1. Types of key informants interviewed

et al. (2022), the TIPI-CAL was used to calculate broiler farm performance, production costs and profitability. The results obtained from the TIPI-CAL model were crosschecked and validated by local experts (researchers). This was performed to ensure that the results were representative of a typical situation.

4. Results

The results are presented in two subsections. The first subsection presents an overview of the state of the Senegalese broiler value chain. It provides a synopsis of the structure, actors and activities of the broiler value chain. The second subsection presents the results of the economic analysis of broiler farms (broiler farm performance, costs of production and profitability).

4.1 Overview of the Senegalese broiler value chain

Discussions held during the multi-stakeholder workshop revealed that hatcheries, producers, feed millers, poultry traders (*bana-banas*), slaughterhouses and distributors (retailers) are the key actors in the Senegalese broiler value chain. Figure 2 shows a simplified graphical presentation of the structure and organization of the Senegalese broiler value chain.

4.1.1 Input supply. The main inputs for broiler production in Senegal are DOCs, feed and veterinary supplies (vaccines and medicines) (Figure 2). Other inputs include bedding (e.g. peanut shells, wood shavings and straw) and water.

Day-old chicks (DOCs): According to the key informants, the number of hatcheries in Senegal has steadily increased over the last two decades, and the country has the capacity to hatch DOCs domestically. This is in line with Arnoldus *et al.*, (2021), who report that the number of hatcheries in Senegal increased from 10 in 2004 to approximately 70 in 2021. The key informants explained that the broiler DOCs used in Senegal come from imported broiler hatching eggs or imported breeder stocks. Further, they stated that hatching eggs are usually imported from Brazil, India and South Africa, whereas breeder stocks are from Brazil, France and the Netherlands. The DOCs are then sold as either “vaccinated chicks” or “unvaccinated chicks,” with the former selling at higher prices. Additionally, the informants noted that there

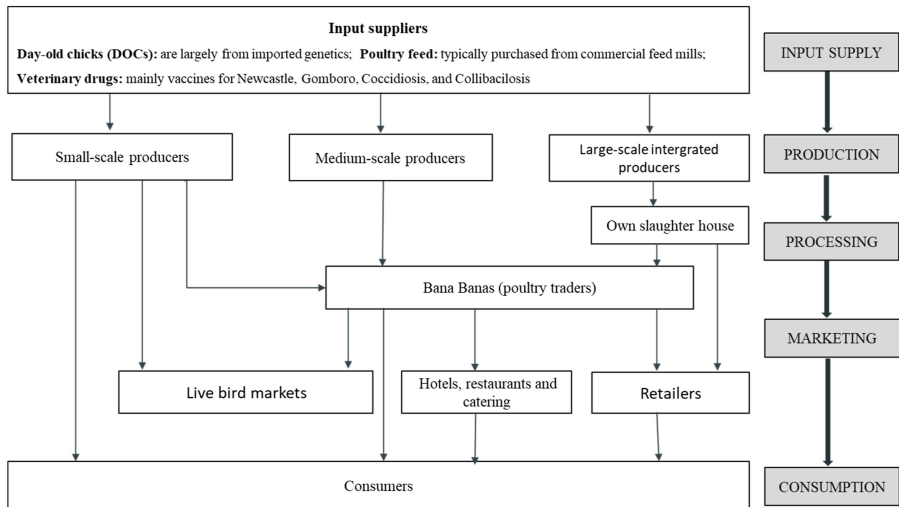


Figure 2. Map of the Senegalese broiler value chain

Source(s): Own illustration

can be shortages of DOCs during peak production seasons and that hatcheries usually import DOCs to meet demand. This is consistent with the data presented in Figure 1.

Poultry feed: According to the key informants, Senegal has a well-developed feed industry comprising several formal feed mills. The key informants explained that feed mills produce commercial poultry feed, which is classified into three categories: starter, grower and finisher. The main feed ingredients are maize and soybean meal. At the time of the interviews, maize and soybeans were imported from Argentina, Brazil, France and Ukraine. Other feed ingredients, include fish meal, peanut meal, amino acids, vitamins and calcium. Fish and peanut meals are usually sourced domestically. The informants also highlighted that feed mills are an important source of employment, as small-scale mills employ five to ten employees. Large-scale mills employ 300–800 employees.

Veterinary supplies and medicines: The key informants reported that the most common broiler chicken diseases in Senegal are Newcastle, Gomboro, Coccidiosis, low pathogenic AI and *Collibacillus*. They explained that vaccines are widely used in commercial broiler production to protect chickens from these diseases. Antistress medicines and vitamins are also widely administered to broilers.

4.1.2 Production. Broiler chicken farms are concentrated along the Senegalese coast in the Niayes Zone. The Niayes Zone stretches from Dakar to St. Louis (see Figure 3) and is ideal for poultry production because of its cooler weather compared to other regions in Senegal (USDA, 2019). High temperatures are a major hindrance to broiler production in Senegal, as they stress chickens and increase their mortality rates (Arnoldus *et al.*, 2021; USDA, 2019). Consequently, the peak season for broiler production in Senegal is from November to May, when cooler temperatures prevail. Production decreases particularly among small- and medium-scale producers (who mostly rear chickens in open barns), from June to October, which is the hottest period. Through the multi-stakeholder workshop and literature review, three conventional broiler production systems were identified and characterized. The conventional broiler production systems include small-scale commercial, medium-scale commercial and large-scale integrated production systems (Table 2). The production systems



Source(s): https://commons.wikimedia.org/wiki/File:Senegal,_administrative_divisions_-_en_-_monochrome.svg

Figure 3. Regions in Senegal

Table 2.
General characteristics
of typical broiler
production systems
in Senegal

	Small-scale commercial	Medium scale commercial	Large-scale integrated
Farm size	<10,000 birds per year	10,000–100,000 birds per year	>100,000 birds per year
Biosecurity measures	Low to moderate	Moderate	Moderate to high
Feed source	Commercial feed-mills	Commercial feed-mills	Operate their own feed-mills
Day old chicks (DOCs)	DOCs are sourced from local commercial hatcheries	DOCs are sourced from local commercial hatcheries	Farms often operate their own hatcheries
Marketing	Live chickens are often sold to traders (<i>bana-banas</i>), individuals and small restaurants	Chickens are either slaughter on the farm or sold as live birds. The birds are often sold to traders (<i>bana-banas</i>), retailers, restaurants and hotels	Chickens are often slaughtered on the farm and sold to <i>bana-banas</i> (with refrigerated trucks), retailers and restaurants
Source(s): Own survey			

were categorized in terms of their scale of production, level of integration of operations, bio-security measures and marketing channels. Section 4.2 provides more details on the farm performance and economics of typical conventional broiler farms in Senegal.

4.1.3 Processing. Approximately 70% of the chickens reared in Senegal are sold as live birds (Arnoldus *et al.*, 2021; FAO, 2014). According to the key informants, formal small-scale slaughterhouses slaughter approximately 200–700 birds per day. Medium-scale slaughterhouses slaughter approximately 4,000 birds per day. Slaughterhouses typically process birds into whole dressed chickens (full chickens). The key informants also reported a growing number of informal slaughtering service providers specializing in de-feathering. These informal slaughtering facilities are located in the main poultry-rearing regions and use mechanical de-feathering equipment. The key informants underlined that the hygiene standards of these informal slaughtering facilities are a major concern as some of them often operate with limited access to running water and there is usually a “cold break” (time outside refrigeration) between the time the chickens are killed, de-feathered and stored in freezers. This cold break can lead to contamination. A recent study by Boimah and Weible (2021) found that Senegalese consumers are concerned with chicken meat hygiene due to an increasing number of reports on contaminated chicken meat.

4.1.4 Marketing. Key informants highlighted that broiler chickens are usually sold either as live birds at the farm gate and at live bird [2] markets or as dressed whole birds to retailers, restaurants and hotels. Poultry traders “*bana-banas*” play a key role in the marketing of chickens as they buy live birds directly from farms and then resell them for a profit (Boimah *et al.*, 2022; Boimah and Weible, 2021; Diédhiou *et al.*, 2022). The *bana-banas* differ in terms of their capacity. The two *bana-banas* who were interviewed explained that on one end of the spectrum, there are small-scale *bana-banas* who buy live chickens from farms and then transport them to live bird markets in cages, which are placed in pick-up trucks. On the other end of the spectrum, there are *bana-banas* who buy slaughtered birds in bulk from medium- and large-scale farms and then transport them in refrigerated trucks. Depending on the capacity of *bana-banas*, they either sell live chickens to consumers in live bird markets, operate small poultry meat butcheries where they sell dressed full birds (fresh or frozen), or supply dressed birds to retailers, hotels and restaurants. The three retailers (supermarket managers) who were interviewed revealed that they usually buy dressed whole chickens weighing more than 1.5 kgs from *bana-banas* or large-scale farms. The retailers then sell them pre-packaged, frozen, or chilled. According to Arnoldus *et al.* (2021) the pre-packaged, frozen, or chilled chickens sold in supermarkets are usually only financially accessible to upper-income consumers, who represent approximately 10% of the population.

4.2 Broiler farm economic analysis

4.2.1 Characteristics of the typical conventional broiler farms. Table 3 presents the key characteristics of typical small- and medium-scale conventional broiler farms constructed using TFA. Typical farms were coded according to Senegal’s country code (SN) and the number of broilers produced annually (SN_9 k, SN_36 k and SN_38 k).

SN_9 k represents a small-scale conventional broiler farm located in Thiès. The farm purchases vaccinated DOCs from local hatcheries, and the chicks are delivered to the farm. The farm owns two chicken coops, each with a capacity of 750 birds per cycle. Due to limited capital, the farm uses a combination of homemade equipment (feeders and drinkers) and purchased equipment. The farm sells live chickens to bana-banas and individuals at the farmgate.

SN_36 k and SN_38 k represent medium-scale conventional broiler farms located in peri-urban areas in Dakar and Thiès, respectively. The farms source vaccinated DOCs from local hatcheries and commercial feed from formal feed mills. The DOCs and feed are delivered to the farms by sellers. SN_36 k rents three coops, each with a capacity of 2000 birds per cycle, while SN_38 k owns two coops, each with a capacity of 3,200 birds per cycle. The two typical farms predominantly sell live birds to bana-banas who come to the farms. However, though rarely, SN_36 k also slaughters birds on the farm and sends them to informal slaughtering facilities that specialize in de-feathering. The slaughtered birds are then packed in plastic bags and sold to bana-banas.

4.2.2 Broiler farm performance. Indicators commonly used to determine broiler farm performance are the feed conversion ratio (FCR), broiler farm economy index (BFEI), mortality rate, length of feeding period and number of production cycles (Chibanda et al., 2022, Van Horne, 2020).

Feed conversion ratio (FCR): The FCR is the ratio of feed consumption to body weight gain for a specific feeding period (Willems et al., 2013; Zampiga et al., 2021). Therefore, the lower the FCR, the more efficient the chickens are in terms of feed use. Feed-use efficiency is affected by several factors, including feed quality, chick quality and husbandry practices (Erdaw and Beyene, 2022). Table 4 shows that, in terms of FCR (feed use efficiency), typical medium-scale farms (SN_38 k and SN_36 k) are more efficient than the typical small-scale farm (SN_9 k).

Broiler farm economy index (BFEI): BFEI measures the overall broiler farm efficiency by combining several indicators (Singh et al., 2017). A BFEI value of 2 or higher indicates good overall farm management. Table 4 shows that all the typical farms have BFEI values higher than 2.00. However, SN_38 k and SN_36 k have higher BFEI values than that of SN_9 k.

Mortality rate: Table 4 shows that the typical farms have mortality rates of between 3.00 and 5.00%. SN_38 k has the lowest mortality rate of 3.50%.

Farm name	SN_9 k	SN_36 k	SN_38 k
Production system	Small scale	Medium scale	Medium scale
Farm location	Thiès	Dakar	Thiès
Farm size (birds sold/year)	8,527	35,263	37,571
Genotype	Cobb 500	Cobb 500	Cobb 500
Origin of day-old chicks (DOCs)	Chicks are sourced from local hatcheries*	Chicks are sourced from local hatcheries*	Chicks are sourced from local hatcheries*
Type of labor	Family labor; 3,500 h/yr.	Permanent labor; 8,400 h/yr	Permanent labor; 3,500 h/yr
Farm ownership	Privately owned farm	Rented coops	Privately owned farm

Note(s): * The DOCs are hatched from imported broiler hatching-eggs

Source(s): Own survey and calculations

Table 3. Characteristics of the typical conventional broiler farms in Senegal

Feeding period and production cycles. According to Smith (2001), in the tropics, fast-growing broiler genotypes such as Cobb 500 can attain an ideal selling live weight of approximately 2–2.5 kg after 35–42 days of feeding. Table 4 shows that SN_9 k, SN_36 k and SN_38 k rear their broilers for 38, 40 and 35 days, respectively. Table 4 also shows that SN_9 k, SN_36 k and SN_38 k run 6.00, 6.20 and 6.10 production cycles per year, respectively. The producers explained that since they have short feeding periods, they can even run up to 8.00 production cycles per year. However, this is not so because of hot weather conditions from June to October, which are unfavorable for production.

4.2.3 Production costs of typical conventional broiler farms. Figure 4 shows that the most significant cost items for all typical farms are feed and DOC costs. Feed costs represent 54% of the total cash costs for SN_36 k, 58% for SN_9 k and 60% for SN_38 k. Figure 4 also shows that the typical small-scale farm (SN_9 k) has the highest production costs followed by SN_36 k and SN_38 k. The farm comparison illustrates that despite differences in geographical locations and ownership types, the cost structures of the two typical medium-scale farms are similar. The medium-scale farms (SN_36 k and SN_38 k) can purchase feed and DOCs at negotiated prices (reduced prices) because they make bulk purchases. By contrast, small-scale farms are unable to buy these items at reduced prices because they often purchase very low quantities of feed and DOCs. For instance, a 50 kg bag of feed costs CFA 16.000 (EUR 24.39) in Thiès, the price at which SN_9 k purchases the bag of feed; however, SN_38 k purchases the bag of feed at a negotiated price of CFA 15.500 (EUR 23.63). Furthermore, SN_38 k purchases a single DOC at CFA 460 (EUR 0.70), while SN_9 k purchases the same chick at CFA 500 (EUR 0.76).

	SN_9 k	SN_36 k	SN_38 k
Feed conversion ratios (FCRs)	2.06	1.78	1.61
Broiler Farm Economy Index (BFEI)	2.43	2.67	3.42
Feeding period (days)	38.00	40.00	35.00
Mortality at farm level (%)	5.00	5.00	3.50
Selling live-weight (kg)	2.00	2.00	2.00
Number of cycles per year	6.00	6.20	6.10

Table 4. Broiler farm performance indicators **Source(s):** Own survey and calculations

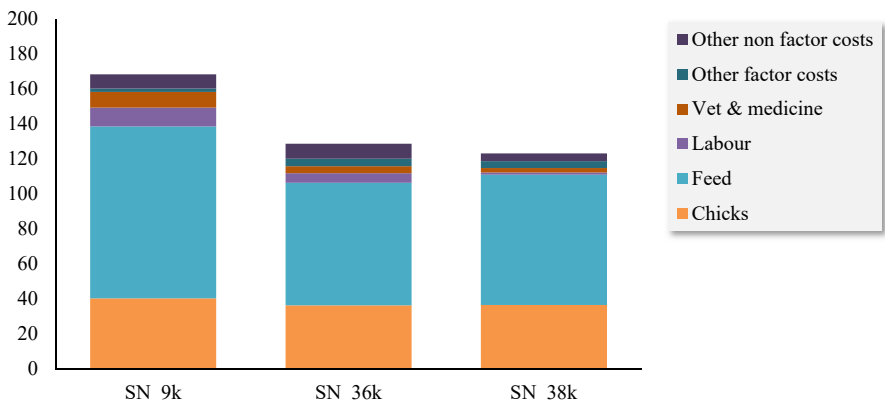


Figure 4. Comparison of production costs of the typical broiler farms (EUR/100 kg live weight)

Source(s): Own survey and calculations

4.2.4 Profitability of typical conventional broiler farms. As shown in Table 5, SN_9 k has the highest returns per 100 kg live weight. According to the key informants, small-scale producers can sell their live chickens at a slightly higher price because they usually market their chickens directly to individual consumers (within their communities). By contrast, larger farms depend almost exclusively on selling their birds to *bana-banas*, who buy chickens at lower prices and then resell them.

Figure 5 shows that the typical small- and medium-scale broiler farms are profitable. SN_36 k has the highest profit margin, whereas SN_9 k has the least profit margin. Although SN_9 k has the highest total returns, it has the least profit margin due to the high production costs.

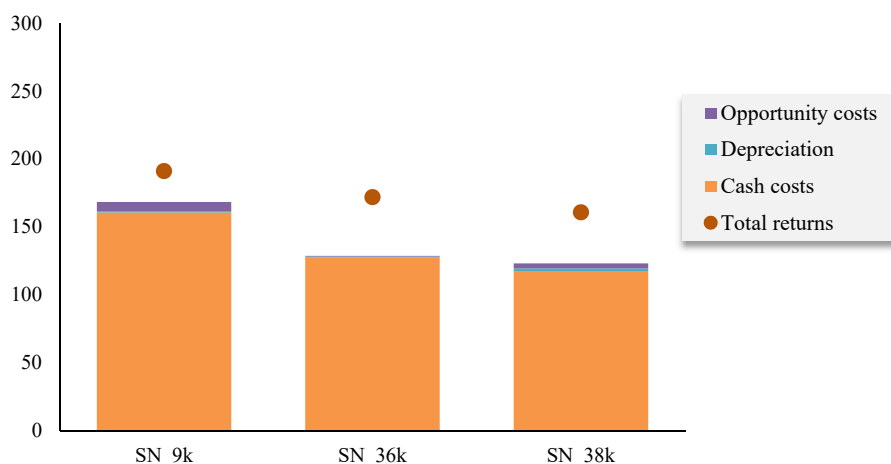
5. Discussion

Chicken meat production and consumption in Senegal have been on an upward trajectory since the ban on poultry meat imports. The results of the value chain analysis suggest that the current situation in the Senegalese broiler value chain is favorable for hatcheries, feed mills, broiler producers and poultry traders (*bana-banas*). For hatcheries, the value chain analysis revealed an increase in the number of hatcheries since the poultry meat import ban. In addition, based on the analysis of typical farms, the results suggest that the hatcheries hatch high-quality chicks because the farms reported relatively low mortalities and FCR values. However, local hatcheries are vulnerable to changes in the international market because they rely on imported hatching eggs to hatch high-quality chicks. This vulnerability was clearly exposed in 2020 when borders were closed and there were no flights due to COVID 19 restrictions.

Indicators	SN_9 k	Typical farms SN_36 k	SN_38 k
Broiler returns	190.56	171.50	160.07
Manure returns	0.67	0.48	0.73
Total returns	191.23	171.98	160.80

Table 5. Comparison of returns of the typical broiler farms (EUR/100 kg live weight)

Source(s): Own survey and calculations



Source(s): Own survey and calculations

Figure 5. Profitability of the typical broiler farms (EUR/100 kg live weight)

According to [Ly \(2020\)](#), importers of hatching eggs could not import hatching eggs due to the restrictions and even when the flights resumed the cost of airfreight had increased significantly.

As for the feed mills, evidence from the key informants and farm performance (especially the FCR values) suggests that the feed millers provide good quality feed. Similar findings were reported by [Arnoldus et al. \(2021\)](#), who conclude that commercial broiler production in Senegal is characterized by the use of high quality chicks (imported genetics) and high-quality feed (imported ingredients). Similarly, [Kenner et al. \(2019\)](#) underline that high-quality feed is essential for achieving good feed-use efficiency. Therefore, by using high-quality feed, chicks and good husbandry (as evidenced by BFEI values), Senegalese medium-scale farms can achieve high farm performance (FCRs and mortality rate) levels. However, the typical small-scale farm is not performing well. Key informants attributed the feed-use inefficiency of the typical small-scale farm to poor husbandry practices, particularly the use of homemade feeders that result in feed losses. This implies that some of the feed that is recorded as being fed to the chickens is not actually consumed but wasted. This result ties well with a study conducted by [Fall et al. \(2017\)](#) which concludes that the lack of technical know-how is one of the key challenges faced by small-scale poultry producers in Thiès.

Similar to studies on broiler farm economics in other West African countries ([Bamiro and Shittu, 2009](#); [Chibanda et al., 2022](#)), the results show that feed costs represent a significant share of the total production costs for all typical farms in Senegal. The feed mill managers explained that feed in Senegal is expensive because the main feed ingredients (maize and soybeans) are imported at high prices. Furthermore, farm economic analysis results reveal that economies of scale influence the cost of inputs (feed and DOCs). More specifically, medium-scale farms can buy chicks and feed in bulk, which improves their negotiating position. Small-scale farms are not in a position to negotiate lower input prices. [Louw et al. \(2017\)](#) analyzed small-scale broiler production in South Africa and reached similar findings. Their findings highlighted that small-scale producers pay more for production inputs because they lack economies of scale. The results also demonstrated that typical small- and medium-scale commercial broiler farms are profitable. However, whether this profitability can be sustained if the current ban on poultry meat imports is lifted is questionable. Given the significantly low production costs in poultry meat exporting countries, such as Brazil and the USA, one can speculate that if the poultry ban in Senegal is lifted, frozen chicken pieces will be much cheaper than domestically produced chicken meat. This could threaten the profitability of broiler production in Senegal.

Our findings also suggest that other segments of the value chain are not faring so well. Notably, slaughtering facilities are currently limited, and most chickens are sold as live birds. Informal slaughtering facilities that have cropped up in recent decades in key production regions, Dakar and Thiès, have played a role in increasing the number of slaughtered birds available to consumers. However, informal slaughterhouses have also become a public health concern owing to poor hygiene issues. Limited slaughtering facilities have a direct effect on consumers. Specifically, consumers have limited choices when it comes to buying chicken meat ([Boimah and Weible, 2021](#)). Their options are usually either purchasing live or whole dressed chickens.

6. Conclusion and recommendations

The aim of this study was to provide an overview of the Senegalese broiler value chain and perform an in-depth farm economic analysis of the different broiler farm types following import restrictions of poultry meat. The value chain analysis revealed that hatcheries, feed mills, broiler producers and poultry traders are currently thriving. However, poultry meat processing facilities are not well-developed. Notably, there are only a few slaughterhouses, and most chickens are sold as live birds.

The farm economic analysis demonstrated that typical medium-scale broiler farms are performing well. Their good farm performance is attributed to the use of high-quality inputs (feed and chicks) and good husbandry. However, the farm performance (particularly feed use efficiency) of typical small-scale farms is inefficient due to poor husbandry. Furthermore, farm economic analysis revealed that feed and DOC costs are the most significant in conventional broiler production in Senegal. Despite these high costs, broiler production is profitable for typical small and medium farms.

Based on our findings, we provide the following recommendations. First, because feed and DOC costs are the main cost items in broiler production, any reduction in these cost items will have a positive effect on the economic performance of broiler farms. In the case of small-scale broiler farms, feed costs may be reduced at the farm level by improving feed-use efficiency. This study revealed that feed-use inefficiency is an issue for typical small-scale broiler farms. Therefore, optimizing feed-use efficiency through proper feeders and poultry husbandry training could reduce feed wastage. As small-scale producers cannot usually negotiate better prices, forming producer organizations “clubs” to buy inputs in bulk may also reduce costs. The costs of DOCs could be reduced by promoting the importation of breeder stocks rather than hatching eggs, as DOCs produced from breeder stocks are more affordable (Arnoldus *et al.*, 2021).

Second, there is also a need to encourage and support investment in poultry meat processing facilities (slaughterhouses). The limited number of processing facilities presents consumers with limited options for chicken meat products available in the market, which has resulted in the mushrooming of informal slaughterhouses. Thus, an increase in the number of processing facilities would provide access to safe and healthy processed chicken meat products (whole chickens, cuts, sausages, etc.) to Senegalese consumers.

Since the farm economic analysis did not include a typical large-scale integrated farm, future studies may focus on the performance and profitability of such a farm type. Furthermore, future studies investigating the international competitiveness of Senegal’s broiler production will be critical in determining whether the country’s domestically produced chicken meat will be competitive against frozen poultry imports in case the poultry meat ban is lifted.

Notes

1. <https://www.aljazeera.com/news/2021/1/8/senegal-reports-bird-flu-on-farm-culls-poultry>
2. Live bird markets are open air markets in which live chickens are sold. Consumers have the option of either buying a live chicken or paying an additional fee to have the chicken slaughtered and de-feathered by the seller.

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Further reading

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