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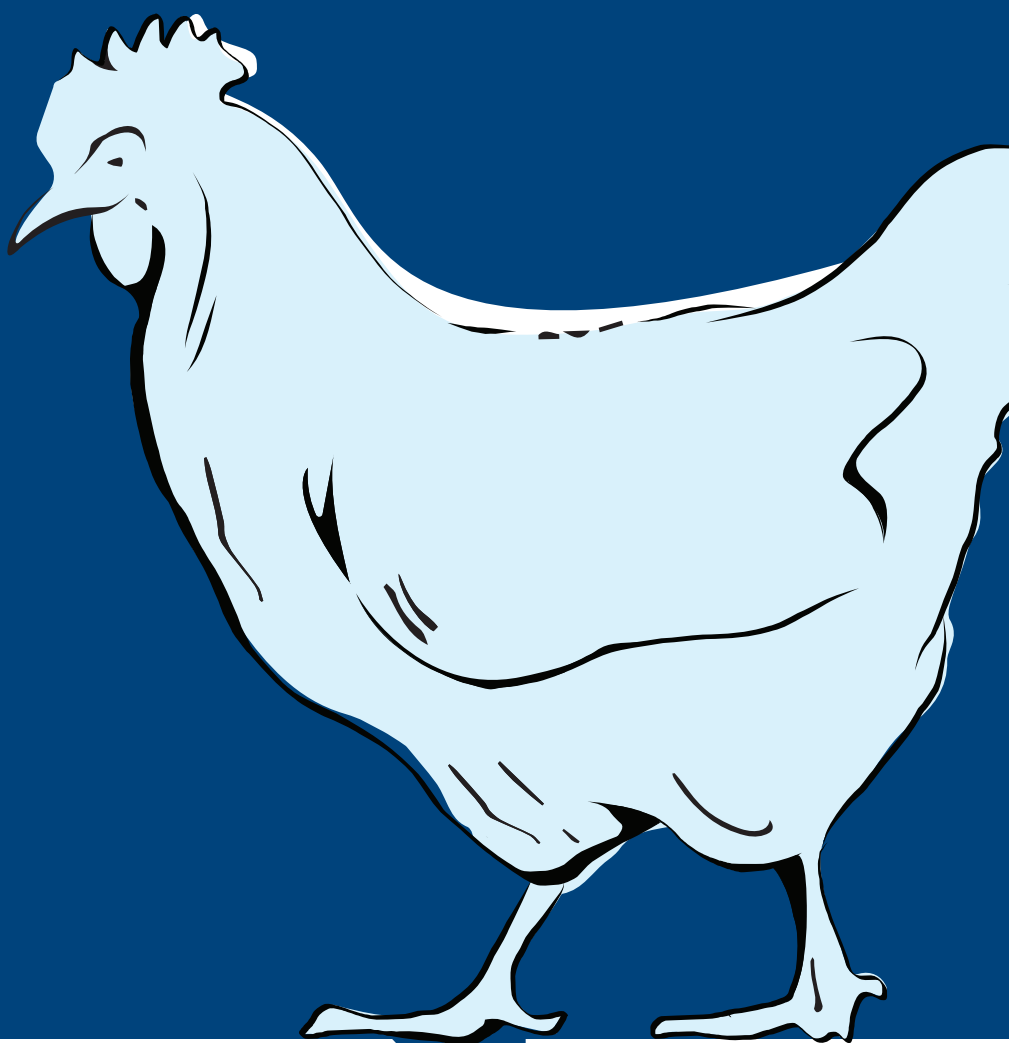
AFRICA
SUSTAINABLE
LIVESTOCK
2050



Business models along the
poultry value chain

EGYPT

*Evidence from the Menoufia and
Qalyubia Governorates*



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Executive summary

This report is the outcome of a collaboration between the Agricultural Economics Research Institute (AERI), the Agricultural Research Centre, and the Food and Agriculture Organization of the United Nations in Egypt (FAO Egypt) to characterize the business model of the different private actors along the poultry value chain.

The specific objectives of the study are to document the business models of enterprises at the different nodes of the poultry value chain, to assess their profitability and to preliminarily assess the prevailing biosecurity measures. The study covers 4 districts in 2 governorates (Menoufia & Qalyubia). The targeted districts are Ashmoun and Quesna in Menoufia governorate and Banha and Kafr Shokr Qalyubia governorate.

The methodology for data collection consisted of semi-structured questionnaires and focus group discussions (FGDs). Thirty-nine enterprises covering the four nodes of the poultry value chain (production, slaughtering, wholesaling, retailing) were sampled. In addition, 16 FGDs were conducted, one for each node in each of the districts.

The main finding is that the surveyed poultry businesses are profitable yet all face limited growth prospects due to internal weaknesses and external challenges. The internal weaknesses relate to the limited maturity of the business operations while the external challenges to the volatile market conditions.

1. Introduction

The Africa Sustainable Livestock 2050 of Food and Agriculture Organization of the United Nations (FAO) and the government of Egypt are supporting a One Health policy dialogue in the Governorates of Menofia and Qalyubia. The policy dialogue aims at identifying public sector procedures (working modalities of public sector officers) that facilitate the adoption of good practices by private sector stakeholders along the livestock value chain. The focus is on actors at all nodes of the poultry value chain – from producers to retailers – and on good practices that minimize livestock-related public health threats associated with zoonotic diseases and antimicrobial resistance.

Stakeholders' adoption of good practices involves some change – from minor to major – in their business model. Stakeholders' willingness to adopt good practices, therefore, also depend on how changes in the business model affect the profitability of the enterprise. This report presents the business models of the different enterprises operating along the poultry value chain in the Governorates of Menofia and Qalyubia.

The report attempts to answer four key research questions:

- To what extent are the poultry businesses profitable?
- Do the poultry value chain actors have the capacity to adopt good practices?
- Do poultry value chain actors have incentives and resources to adopt them?
- Can poultry value chain actors access finance to adopt good practices?

2. Egypt's poultry sector

2.1 General overview

The poultry industry is considered as one of the important agricultural production activities in Egypt. The value of poultry production amounts to about EGP 62.2 billion (EGP 46.8 billion for poultry meat and EGP 15.4 billion for table eggs), representing about 33 percent of the total value of animal production, which amounted to about EGP 188 billion in 2018¹. The local production of poultry meat (white - baladi) in Egypt was about 1.32 million tonnes in 2018, representing a self-sufficiency ratio of about 97 percent (MALR, 2019a). However, Egypt is a net importer of poultry feed, primary genetic material (GPS), veterinary medicines and vaccines.

The per capita consumption of white meat in Egypt is estimated to be 11.4 kg per year, that is 31.2 grams per day (MALR, 2019a). Protein from poultry is characterized by good nutritional value, affordability, and higher nutritional conversion factor compared than red meat.

In recent years, poultry production in Egypt has transformed into an industry in order to satisfy the increasing consumer demand for affordable animal protein. However, the sector is still developing and faces numerous challenges, such as high input prices, regular disease outbreaks, consumer preferences for live birds among others. The absence of a national strategy for developing the poultry industry limits the capacity to coherently address some of these challenges.

2.2. Structure of the broiler industry

In 2018, the number of hatcheries reached 380, with a total annual production capacity of 2.4 billion day-old-chicks (DOCs) (details in Annex 2). The actual number of DOCs produced, however, was about

¹ EGP 15.7 = USD 1.

952 million broiler DOCs and 54.4 million layer DOCs. There are 243 poultry feed factories in Egypt with a total production capacity of about 5.9 million tonnes annually. The actual production only reached about 2.2 million tonnes in 2018, implying that plants are operating at a rate of 37.3 percent (MALR, 2019b). The government veterinary services as well as the private veterinary practices play a crucial role in the ensuring poultry production is free from disease, with producers adopting good biosecurity practices.

2.2.1. Broiler production

In 2018, the production capacity of the commercial broiler sector was about 690 million chickens (details in Annex 2), while farmers in rural sector produced about 159 million chickens, resulting in a total production of about 849 million broilers. The number of commercial broiler farms across the country is 20 997 farms with a total of 31 644 chicken houses, of which 30 645 are working while 999 are not working. The combined capacity of all chicken houses amounts to 1.2 billion birds (MALR, 2019b).

Broiler farms with a production capacity ranging from 5 000 to 25 000 chickens produced of 63.6 million chickens; farms with production size from 25 000 to 100 000 chickens produced about 342.9 million chickens; farms of a size greater than 100 000 chickens produced about 283.7 million chickens in 2018. The three categories represent 9.2, 49.7, and 41.1 percent of the total broiler production, respectively (MALR, 2019b).

2.2.2. Poultry slaughterhouses

The total number of poultry slaughterhouses in Egypt is 325 with a capacity of processing 3 280 000 birds per day. This figure includes 49 automated slaughterhouses with a capacity of 1 960 000 birds per day, 75 semi-automated slaughterhouses with a capacity of 1 200 000 birds per day, and 210 manual slaughterhouses with a capacity of 120 000 birds per day (MALR, 2019b).

The Ministry of Agriculture & Land Reclamation is implementing a plan to increase the number of automated slaughterhouses across the various governorates. In particular, one of the objectives is to encourage the establishment of so-called broiler complexes, that is fully-equipped closed farms with an automated slaughterhouse and a special unit for waste treatment. Broiler complexes are expected to comply with international best practices.

2.2.3. Poultry marketing

Figure 1 displays the main channels for broiler marketing. Live / fresh poultry represents 64 percent of the market share, while chilled / frozen poultry represents 36 percent of the market share. Rural residents believe that frozen or chilled slaughtered chickens might have been sick or dead, so they prefer to buy live chickens to be slaughtered in their presence (Shatokin *et al.*, 2017).

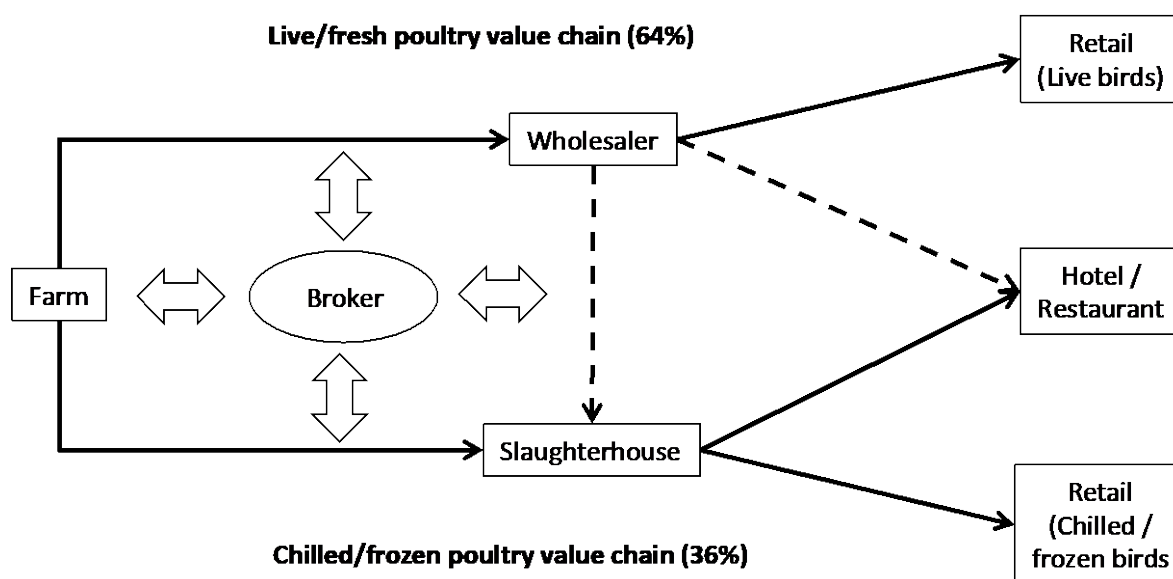


Figure 1: Main marketing channels for broilers

2.2.4. Poultry pricing

A group of brokers distributed across the governorates control the pricing of live poultry in Egypt. The price is established daily according to supply and demand trends, with brokers reducing or raising the price depending on requests received by wholesalers vis-à-vis marketable birds. In general, poultry prices are higher in winter due to limited supply, and during religious periods due to the increased demand; they are lower in the summer and after the blessed Eid al-Adha.

3. Methodology

In order to identify options to improve the efficiency of the Egyptian poultry sector, and make poultry businesses more profitable as well as more sustainable from a public health and an environmental perspective, we performed an analysis of the poultry businesses in the governorates of Menoufia and Qalyubia, including the districts of Banha and Kafr Shokr in the governorate of Menoufia and the districts of Ashmoun and Quesna in the governorate of Qalyubia.

These governorates were selected upon indication of the General Organization of Veterinary Services under a criterion of proximity to the capital city but differences in the level of production. Qalyubia is a large hub for poultry production, mainly comprising old businesses that started the poultry commercial industry in Egypt in the 1980s. The businesses own a wide distribution networks to all governorates and Cairo. Menoufia, by contrast, is characterized by the combined presence of small to medium poultry producers and some large commercial farms. In both governorates, poultry production is considered a peri-urban industry.

We first portrayed the poultry value chain in the two Governorates and identified the major nodes where different poultry businesses operate: production, slaughtering, wholesaling and retailing. Then, we designed light, semi-structured surveys aimed at characterizing the Business Model Canvas, the Business Process Model (details in Annex 1), and the Enterprise Budget of a typical business at each of the value chain node. We tested the survey instruments on the ground for refinement and finalization. AERI invited twelve researchers / data collectors from the governorates of Menoufia and Qalyubia to its premises in Giza to provide them background information on the study and discuss the

questionnaires. The researchers then tested the questionnaire in the four selected districts and, during a second meeting, reported issues and challenges for its amendment and finalization.

We used a three-pronged approach to gather data. For each node of the poultry value chain, first we held focus group discussions in each of the districts with stakeholders to gather qualitative information on their business. Second, we administered the semi-structured questionnaires to participants in the focus group discussion to gather some quantitative data. The average number of attendees was 12 actors per node. Finally, with the exception of slaughterhouses, we visited three enterprises at each node of the poultry value chain to collect detailed information to validate the gathered data and collect data on the enterprise budget. The total number of sampled enterprises is presented in Table 1.

Table 1: Number of sampled enterprises by district and value chain node

	Production	Slaughterhouse	Wholesale	Retail	Total
Menoufia					
Ashmoun	3	1	3	3	10
Quesna	3	0	3	3	9
Qalyubia					
Banha	3	1	3	3	10
Kafr Shokr	3	1	3	3	10
Total	12	3	12	12	39

4. Findings

4.1. Broiler production

Most of the chicken houses in the sampled districts have an area of 500 square meters, operate as open-house ground system, and have a production capacity of about 5 000 broilers/cycle. The main difference between the two governorates is that producers in Menoufia complete six broiler production cycles per year compared to five cycles in Qalyubia.

About 90 percent of the broiler ‘farms’ are rented with all required equipment and accessories from former poultry producers. In Qalyubia governorate, loans are the main source of finance for a production cycle while in Menoufia operators cover two thirds of the production costs with their own resources. The distance between farms and residential areas ranges from 100 m to 5 km, which makes the adoption of strict biosecurity practices critical to minimize any public health threats.

Among the most important challenges facing broiler producers are the increasing and fluctuating input prices and, in 2020, the low market price of live poultry.

4.1.1. Business model canvas

Value proposition: Producers aim to provide healthy chicken of desired weight (app. 2.5 kg) at an affordable price to consumers. This requires that the flock remains free of diseases. Producers, tend to apply more biosecurity measures to mitigate the risk of disease introduction (bio-exclusion) than bio-containment measures to control pathogens within their flock. A veterinarian, in fact, is only called in case of any disease problem beyond the owner's control. In addition to healthy chicken, customers value cleanliness and easy access to the farm.

Key partners: Day old chicks (DOCs, e.g. Cobb Valley, Arbor Acres, Ross) are sourced from large companies (Al-Anani, Al-Wadi, Abdul Salam Hegazy) or their regional distributor. The price of DOCs is

determined by supply and demand mechanisms. Prices are lower in winter compared to summer. Receiving infected DOCs is one of the problems broiler producers often face. The companies only provide a warranty of three days after the supply of the DOCs.

Poultry feed is purchased from large companies (e.g. Mit Ghamr Dakahlia; Wadi el Natroun; Dokki Giza) or their agents. Feed prices are affected by international market dynamics, as most of the feed ingredients are imported. The local feed market is dominated by a small number of importers who tend to practice monopolistic strategies, which often result in unjustifiably high feed prices. There are only few feed wholesalers and retailers.

The producers obtain DOCs and feed from the companies upon payment of an installment of between one and two thirds of the total cost, e.g. EGP50 000 to 100 000 for a batch of 5 000 birds. The balance is paid after the sale of the birds.

Medicines and vaccines are procured at district pharmacies or from feed companies. Many producers purchase medicines and vaccines from stores that sell poultry supplies whose price is often low. However, for most of these medicines and vaccines quality is not guaranteed. Sometimes producers get their medical supplies from local traders.

Carpenters or wood companies are the suppliers of sawdust used as litter.

In Banha, Kafr Shokr and Quesna districts, government veterinary services have no role in routine broiler production, while in Ashmoun district veterinarians collect samples from birds before sale for avian flu testing at a fee of EGP 450. However, the owners are not informed of the test results.

A broker who controls the area is the main actor in the marketing process. He acts as a mediator between the producers and wholesalers. Brokers control the price by applying pressure on the farm owners who want to sell their birds as soon as possible to avoid extra costs of feeding and management by waiting extra days.

Key resources: Experience in broiler production is a key factor and essential asset for the success of the business. The enterprise also requires a sufficient number of skilled workers to carry out the daily work. Often, only one resident worker is employed to limit the risk of disease introduction, while the farm owner supervises the production cycle from the beginning to its end.

Most of the producers do not have access to financial institutions and, therefore, having a sufficient capital to cover all essential expenses is key to run a broiler business.

Key activities: A production cycle lasts for a period of 35 to 40 days. The key activities of broiler production are listed in Table 2. More details are provided in the 'business process' section.

Table 2: Key activities at the production node

Activity	Timing/Frequency
Cleaning and disinfection of chicken house	One week before purchase of production inputs
Washing of equipment	Before production cycle starts
Preparing drinkers and feeders	
Purchase of production inputs	
Designation of one laborer for a chicken house	
Spreading of sawdust on the floor	
Vaccination and medication	During production/variable
Regular provision of feed and water	During production/daily
Regulation of chicken house temperature	
Monitoring of feed consumption and growth	
Disposal of dead birds and waste	
Contacting the broker	At the end of the cycle before selling birds
Communicating with customers	
Management of records and accounts	Daily

Customer segments: Most of the broiler farms in the study area produce live chicken and sell them to wholesalers through a broker. Some farms deal directly with hotels and restaurants. In addition to that, some producers directly sell to barbecue shops small-sized chicken (less than 1 kg) for grilling.

Customer relationships: The relationships between producers, brokers, and wholesalers are simple. In general, the producer does not meet the broker and only knows his phone number; he only asks him to find a wholesaler willing to buy the chicken. The relationship with the wholesaler is temporary and ends with the sale of the chicken. Poultry manure, a by-product, is sold to fruit tree farms in the area as fertilizer by the cubic meter (at EGP 300/m³). Often, these farms belong to friends, neighbors or relatives of the farm owner. Manure is sold in through direct contact with the buyer.

There is no any direct contact between the producer and the slaughterhouse. Sometimes, however, if a serious disease occurs on a broiler farm, all farm owners in the area take their chicken to the slaughterhouse to slaughter the birds before they die, or slaughter them in an isolated area in the farm and sell them to barbecue shops at low prices.

Channels: Poultry prices are disseminated daily by the brokers through social media, mainly Facebook, without any interference from the state. Communication between producers, brokers and wholesalers is by mobile phone.

Cost structure: Fixed costs account for two percent or less of the total costs of broiler production. The main variable costs are feed, DOCs and disinfectants/medicines/vaccines, accounting for around 60, 20 and 10 per cent of the variable costs (details in the enterprise budget section). The cost of casual of labour amounts to less than two percent of the total variable costs.

The total cost of producing 5 000 chickens ranged from EGP 145 000 to 181 000 in 2020. In 2012, before the COVID-19 pandemic, the total cost of producing 5 000 chickens never exceeded EGP 140 000. The increase in production costs in 2020 is attributed to the increase in global prices for yellow corn and soya beans, which resulted in an increase of the price of chicken feed to EGP 6 500 per ton, 14 percent higher than in 2019, as well as to an increase in the price of imported medicines and vaccines, which are widely used and more trusted than local medicines and vaccines.

Revenue streams: Virtually all (>95 percent) revenue originates from the sale of live chickens, followed by the revenue received from the sale of the manure (details in the enterprise budget section). Upon collection of the batch of birds, the wholesaler pays the agreed price in cash.

There are about 5 to 6 cycles per year for each broiler chicken house. Total revenue for a cycle of 5 000 broilers ranged from EGP 210 000 to 375 000, varying by farm and season, with the net profit ranging from EGP 60 000 to 220 000 per cycle. Highest returns are achieved with the third cycle, in mid-year, while the lowest occur towards the end of the year. According to the producers, in winter they use more vaccines and medicines compared to summer due to higher risk of disease outbreaks and spread.

4.1.2 Business process

The business process is detailed in Figure 2.

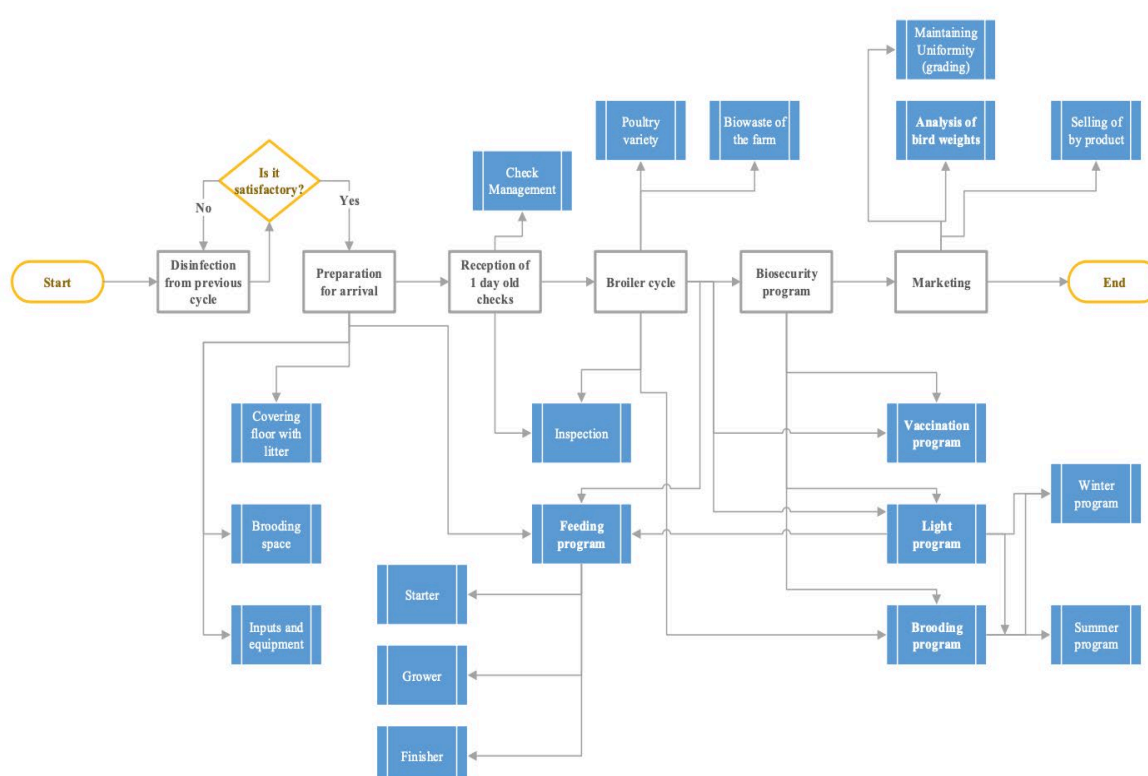


Figure 2: Business process modelling chart for broiler production

Preparation for the production cycle

- The poultry house is inspected (ventilation openings, electrical circuits, water connections, ceiling fans) and cleaned.
- The walls and floors of the chicken house are covered with gypsum and table salt.
- The house is disinfected with 20 percent formalin.
- Sawdust to serve as litter is purchased from carpenters and transported to the farm by the producer. A chicken house of 500 m² requires 2 tonnes of litter. The litter can be changed in the middle of the cycle but at times it is used for the entire cycle with change of the wet parts only.
- The manual feeders and drinkers are checked and filled for the reception of the DOCs.

- A brooding space is dedicated to the DOCs. This space is expanded as birds grow until it covers the entire chicken house.
- One worker in addition to the farm owner (or the permanent worker) is hired for preparation of the chicken house.
- DOCs and feed are ordered/purchased. The number of birds ordered depends on the area of the chicken house.

Broiler production

- One worker or the owner is responsible to continuously monitor the chicken during the production cycle.
- During the first week, the chicks are placed in the chicken house with sugar water, then plain freshwater, followed by an antibiotic of 5 mm per litre of water for a period not exceeding four hours. Then chicks are provided vitamins A, D, and E for four hours.
- In the growing stage, the chickens receive a feed ration (23 percent protein concentration) to grow until reaching a weight of about 1.25 kg; then the birds are given a feed ration with 21 percent protein concentration. Production of a kg of broiler meat requires between 2.00 and 2.25 kg of feed. A good feed conversion rate requires the integration of three elements, that is good quality chicken, good feed, and proper husbandry.
- The chicken house is cleaned daily.
- Medicines and vaccines are given to the chickens at varying times during the production process. Bird mortality is around 5 percent.
- Good ventilation is required in summer, e.g. through fans, while good heating must be provided in winter, usually through gas cylinders.
- Longer periods of lighting (21 hours per day) are used at the beginning of the production cycle. After two weeks, this period decreases to about 19 hours per day and may reach 16 hours per day half way through the cycle.
- The poultry workers are instructed in biosecurity practices, especially in using disinfectants every time they enter and leave the chicken house.
- Regarding record keeping, the producer records the day the chickens are received, their type, number, and price. In addition to that, quantities of feed consumed are recorded daily and medication and vaccine programs are registered. All major expenses (sawdust, gas, wages, rent, electricity, etc.) are duly noted.

Marketing

- The producer calls a broker to find a wholesaler (or slaughterhouse) and negotiate the quantity and price of chicken to be sold. Between 5 and 10 percent of birds are rejected because of small size
- Poultry manure is sold to crop farmers to be used as fertilizer. Sometimes an intermediary, who buys large quantities from several farms, stores, and sells them at higher prices, enters into this process.

4.1.3. Enterprise budget

The annual budgets of the farms in the districts Banha, Kafr Shokr, Ashmoun, and Quesna are presented in Table 3. The average net profit margin, that is the profit expressed as percentage of the revenue from the sale of birds and manure, is 47.7, 52.0, 41.1, and 45.3 percent, respectively, over the five to six broiler cycles. Net profit margins range from 19 to 61 percent depending by the cycle.

Table 3: Annual enterprise budgets of broiler producers (Egyptian Pounds, EGP 15.7 = USD 1)

Item	District			
<i>Revenue</i>	Banha ¹	Kafr Shokr ¹	Ashmoun ²	Quesna ²
Broilers	1 570 342	1 551 402	1 637 582	1 644 966
Sarda & Farza ³ sales	8 000	8 000	6 395	6 492
Manure	34 500	37 500	24 980	25 220
Total Revenue	1 612 842	1 596 902	1 668 957	1 676 678
<i>Variable costs</i>				
Birds (DOCs)	166 833	182 917	203 335	205 417
Feed	530 566	452 933	606 000	573 467
Medication	60 000	46 667	79 000	56 000
Sawdust (litter)	22 000	25 333	29 333	26 700
Casual labour	14 165	10 667	16 500	12 000
Energy	27 368	27 483	30 950	26 892
Water	1 500	1 250	2 601	1 800
Broker	1 665	865	1 998	1 038
Total variable costs	824 097	748 115	969 717	903 314
Returns over variable costs	788 745	848 787	699 240	773 364
<i>Fixed costs</i>				
Chicken house rent	15 000	15 000	10 000	10 000
Maintenance	1 665	2 000	2 000	1 250
Real estate taxes	2 333	2 000	1 650	2 000
Total fixed costs	18 998	19 000	13 650	13 250
Total costs (variable & fixed)	843 095	767 115	983 367	916 564
<i>Indicators</i>				
Returns over total costs	769 747	829 787	685 590	760 114
Return/bird	30.8	33.2	22.9	25.3
Net profit margin (%)	47.7	52.0	41.1	45.3
Fixed costs/revenue (%)	1.2	1.2	0.8	0.8

¹ Five cycles of 5,000 birds/year; ² Six cycles of 5,000 birds/year; ³ Underweight & deformed chicken

4.1.4. Biosecurity and public health practices

Applied biosecurity measures are sub-optimal and government regulations often not complied with. The observed failures comprise:

- Most of the farms are old, unlicensed, and do not meet standard biosecurity requirements. For example, the distance between farms is often less than one kilometre, vehicles entering the farm are neither washed nor disinfected, workers do not shower or change clothes, disinfectant in footbaths is not changed regularly, etc.
- In violation of regulations of the Ministry of Agriculture and Land Reclamation for establishing broiler farms, broiler farms are often close to agricultural land and/or near residential blocks.
- The disinfection process prior to the beginning of a cycle is applied to the chicken house only, while neglecting the feed store and housing of workers.

- Farms rarely provide workers sets of clothes for working within the chicken house.
- Farm workers are not fully accommodated on the farm during the production cycle and regularly leave and re-enter the farm.
- Some farms don't use their own equipment for flock vaccination but rely on those of the vaccinator, which is a risk for diseases transmission.
- The footbath for disinfecting shoes at the entrance of the farm and chicken house is not regularly replenished.
- At times, trucks are allowed onto the farm without cleaning and disinfection.
- In the case of disease or deaths, producers examine poultry and perform post mortem inspection on their own without consulting a veterinarian to diagnose the cause of illness or death.
- Producers regularly use medicines, especially antibiotics and vaccines, without veterinary supervision. Often, they use ineffective and expired medicines and vaccines available on the market, which results in poor treatment outcomes and low flock immunity.
- Due to lack of possibilities of safe disposal of dead birds, e.g. through incineration, it is common for farmers to dump them in canals, along canal banks and public roads, sell them to dog shelters, or to a truck passing that collects dead birds for five EGP per chicken.
- Poultry are sold at the sole discretion of the producer without prior inspection by government veterinary services. This contravenes Law 70 of 2009 regulating the handling of live poultry.

4.2. Poultry wholesale

Wholesalers source chickens from the broiler farms located within their same district or governorate. Their challenge is to find chickens that conform to the customers' requirements. Besides the truck driver, wholesalers do not hire any staff except some temporary workers to load and unload the chicken.

Most of the wholesalers in rural areas work without a trade license and, hence, cannot obtain loans from banks. All four interviewed wholesalers self-finance their business. Wholesalers don't have a commercial registry, tax card, or fixed office address. Sometimes they inherited the enterprise, which is considered a family business.

4.2.1. Business model canvas

Value propositions: the wholesaler sources healthy chickens with the characteristics requested by the client, mostly retailers but also hotels and restaurants and, occasionally, slaughterhouses. Wholesalers are very experienced in distinguishing healthy from unhealthy chicken.

Key partners: The main partners are brokers and the owners of the broiler farms.

Key resources: The key assets of the wholesalers are one or more transport trucks and chicken cages. The business builds on long-standing and trusty relationships with retailers

Key activities: The key activities of the wholesaler are listed in Table 4. More details are provided in the 'business process' section.

Table 4: Key activities at the wholesale node

Activity	Frequency
Communicating with customers to identify their demand	Daily
Contacting the broker to find out which broiler farms have chickens ready for sale	As needed
Visiting the farms proposed by the broker	In the morning to check chickens;
Purchase, catching of chickens, putting them into cages, weighing and loading them onto the transport vehicle	The loading is made during the night so that the workers can catch the chickens after turning off the light of the farm. This reduces crowding of chicken in one place, which may cause their death.
Delivering the chickens to customers	Directly after purchase of the chickens
Collecting payment from retailers	Daily, after selling the chickens
Management of accounts	Daily

Customer segments: Retailers are the main customers, followed by hotels, restaurants and occasionally slaughterhouses.

Customer relationships: The relationship between wholesaler and retailer has been going on for many years and is one of the strongest in the poultry value chain. This relationship is based on mutual trust. By contrast, the relationship between wholesalers, restaurants, and slaughterhouses is casual.

Channels: Wholesalers transport chicken every day to satisfy chicken orders from retailers or other customers. Communication with retailers is through mobile phone or direct contact. Information on daily poultry prices, the retailer's poultry needs, and delivery dates is exchanged daily. Information on prices is obtained through the internet or the chicken stock exchange. According to the wholesalers, retailers are demanding approximately 2 000 kg of chicken per week. The farm gate price varies between EGP 18 and EGP 20 per kg of chicken.

Cost structure: Fixed costs, mainly the capital invested in vehicles and cages, account for less than one percent of the total costs of the wholesale business. The purchase of poultry represents close to 98 percent of the total variable costs, with the cost of casual labour and transporting the chicken accounting for around one percent each (details in the enterprise budget section).

Revenue streams: At collection, the wholesalers pay the chicken in cash. The chickens are delivered to the retailers in the same night and the retailers pay for the chicken immediately or in instalments (at an interest rate of around five percent per day).

4.2.2. Business process

Details of the business process are presented in Figure 3.

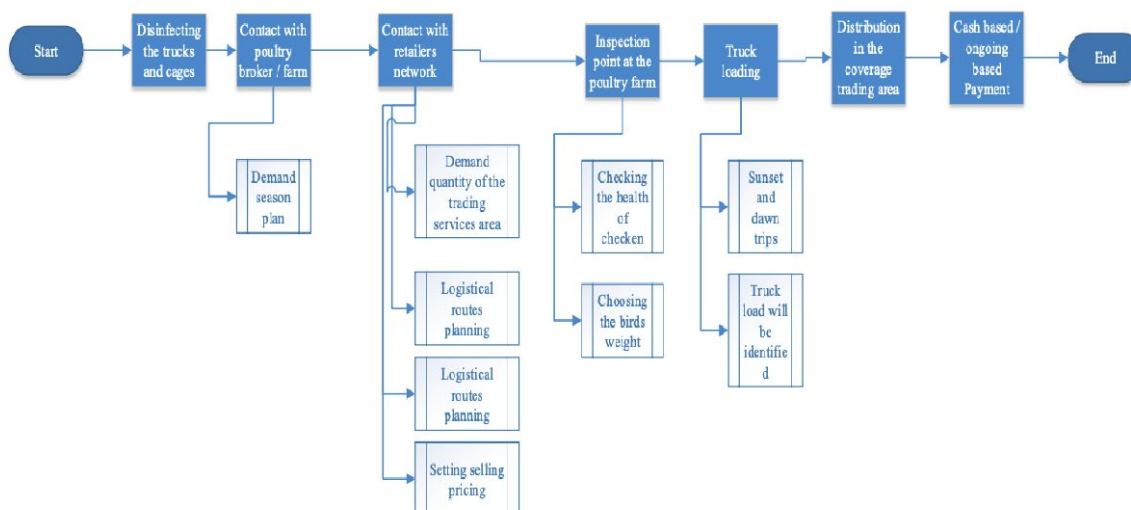


Figure 3: Business process modelling chart for broiler wholesale

Identification of business opportunities

- Known customers are contacted by mobile phone to assess demand.
- Brokers and broiler producers are approached for information on the market price and availability of chickens ready for sale. Other traders may be contacted to obtain additional information on poultry prices.
- The wholesaler visits those broiler farms that have chicken of the desired size to examine the birds and agree on the price.

Collection and delivery of the purchased chickens

- The truck and cages may be washed with water and disinfectants, but in most cases, cleaning is done only when the equipment is dirty, on average once per week. The wholesalers report, however, that they wash and disinfect the truck and cages only when dealing with large companies with strict biosecurity rules, since the cost of washing the truck is about EGP 60 and washing a cage costs EGP 5. Some large companies disinfect the truck and the cages of the wholesaler for free.
- The truck arrives at the farm at night to load the chicken. A truck can carry around 570 chickens (of an average weight of 1.5 to 2.5 kg) in about 50 plastic cages (one cage can accommodate slightly more than 10 chicken).
- The chickens are paid in full before the wholesaler leaves the farm and are delivered to retailers on the same night.
- If the retailer pays the wholesaler in cash upon delivery, the mark up is about one EGP for every kg of chicken. In the case that the retailer postpones payment to the wholesaler, another EGP is charged for each kg and day of delay. As the retailer usually does not pay for the poultry directly to the wholesaler, but rather pays him according to what he sold the next day, commonly two pounds are added to each kg of poultry.

4.2.3. Enterprise budget

The four sampled wholesalers trade between 18 000 and 36 000 birds per month (between 30 and 65 truck loads). Their net annual profit ranges from EGP 0.9 million to EGP 1.4 million (Table 5). Fixed

costs are minimal as wholesalers don't have an office from which they manage their business nor permanent workers who are paid a monthly salary. Depreciation of vehicles and cages was not considered in the budget as it represents a negligible budget item in the wholesalers' business. Wholesalers have a net profit margin between seven and nine percent.

Table 5: Annual enterprise budgets of poultry wholesalers (EGP 15.7 = USD 1)

Item	District			
<i>Revenue</i>	Banha	Kafr Shokr	Ashmoun	Quesna
Chicken sales	11 280 000	22 338 624	14 016 000	17 168 000
Total Revenue	11 280 000	22 338 624	14 016 000	17 168 000
<i>Variable costs</i>				
Chicken purchase	10 152 000	20 565 717	12 614 400	15 451 200
Transport from farm to customer	96 000	115 200	115 200	168 000
Casual labor	144 000	240 000	111 984	140 016
Vehicle maintenance	7 200	12 000	48 000	48 000
Broker	16 800	16 800	16 800	16 800
Total variable costs	10 416 000	20 949 717	12 906 384	15 824 016
Returns over variable costs	864 000	1 388 907	1 109 616	1 343 984
<i>Fixed costs</i>				
Taxes	1 833	2 767	3 000	2 800
Total fixed costs	1 833	2 767	3 000	2 800
Total costs (variable & fixed)	10 417 833	20 952 484	12 909 384	15 826 816
<i>Indicators</i>				
Returns over total costs	862 167	1 386 140	1 106 616	1 341 184
Profit/bird	3.63	2.88	3.75	3.71
Net profit margin (%)	8.28	6.62	8.57	8.47
Fixed costs/revenue (%)	0.02	0.01	0.02	0.02

Transportation costs about EGP 400 per transfer in pickup trucks (3t cargo) while using class 3 box trucks (5t cargo) increases the cost to about EGP 1 000 per transfer. The cost of transporting poultry increases during holidays and on religious occasions. Due to the experience of wholesalers in choosing healthy chickens, mortality during transport is below one percent.

4.2.4. Biosecurity and public health practices

Poor biosecurity and public health practices of wholesalers comprise:

- Cleaning and disinfecting trucks and cages are done once a week on average, rather than before any transport.
- Workers not handling the birds properly while catching them for loading.
- Throwing dead chicken onto roads, into canals, into the garbage, or they selling them to dog breeders.
- Not having an official permit to transport live poultry, and a truck that is intended for transporting live poultry only.

4.3. Poultry slaughterhouses

The manual slaughterhouses in Banha and Kafr Shokr districts in Qalyubia governorate are located at a distance of 2 km from residential areas. The owners, however, contend that they should be located closer or inside residential areas, not differently than retailers. The capacity of each of the manual slaughterhouses is 1 500 birds/day. However, the slaughterhouses are operating far below capacity with a daily throughput of about 500 birds. The owners of the slaughterhouses operate informally and cannot access loans from financial institutions to expand their business.

The semi-automated slaughterhouse in Ashmoun district in Menoufia governorate is owned by the Tetra company, a poultry integrator that invests along the entire chain from parent breeder, broilers, slaughter to retail. The slaughterhouse has a total capacity of 3 000 birds/hour but the actual throughput, however, is only around 1 500 to 2 000 birds/day. The slaughterhouse applies good safety and biosecurity measures, from inspection of the poultry upon arrival until they leave the slaughterhouse as chilled or frozen chicken. A veterinarian appointed by the Ashmoun Veterinary Department permanently supervises all processes. The chilled and frozen chickens are transported to supermarkets and chicken processing companies in containers with coolers. The slaughterhouse is preparing all documentation necessary to obtain the ISO 45001 - 9001 - 22000 standards.

4.3.1. Business model canvas

Value propositions: The manual slaughterhouses in Qalyubia provide customers, mostly hotels and restaurants but also retailers and supermarkets, with fresh (chilled) chicken and chicken parts. The semi-automated slaughterhouse in Menoufia supplies supermarkets and food processors with safe, fresh (chilled) and frozen chicken and chicken parts. All slaughterhouses have developed a trust-based relationship with their customers through providing quality products and adhering to contracts.

Key partners: Wholesalers and broiler producers are the main partners for the manual slaughterhouses in Qalyubia. The semi-automated slaughterhouse in Ashmoun mainly serves the broiler farms of the Tetra company, which produce around 750 000 birds per year. Tetra's own production covers about two thirds of its clients' demand, while the remaining broilers are sourced from wholesalers in the region. The government veterinary services are also considered a key partner for the semi-automated slaughterhouse as they are responsible for the inspection of birds before, during and after slaughter.

Key resources: The manual slaughterhouses have been inherited and most of the working capital originates from the family's savings. The owners hire qualified and trained workers and use casual labor when required. The key resources are the premises and the workers.

The Tetra company owns all assets and provides key resources (administrative, logistics and vehicles) for the operation of the semi-automated slaughterhouse. The slaughterhouse has 30 hired permanent workers and 5 casual workers, which can be increased when the need arises.

Key activities: The key activities are listed in Table 6. More details are provided in the 'business process' section.

Table 6: Key activities at the slaughtering node

Manual slaughterhouses	Semi-automated slaughterhouse
Routine cleaning: daily	Routine cleaning: twice a day (water, soap, and alkaline disinfectant)
ND	Deep cleaning: twice a week (water, soap, and acidic disinfectant)
ND	Analysis of samples from chickens at the Animal Health Research Institute for heavy metals, pesticides and bacterial contamination once a week
ND	Calibration of scales by the General Authority for Calibration every month
ND	Veterinary examination of delivered poultry to ensure they are free from diseases.
Sorting of chickens by weight	Sorting of chickens by weight
Slaughter according to Islamic law	Attaching the chickens to the chain and manual slaughter according to Islamic law
Placing chickens in the scalding basin for 2.5 minutes	Placing chickens in the scalding basin for 2.5 minutes
Removal of feathers with a defeathering machine	Removal of feathers with two machines for one minute/bird
Cutting of legs and the head	Cutting of legs and head and placement in a basin of lukewarm and then of cold-water
Manual evisceration	Manual evisceration, the liver and gizzard are kept and the rest is disposed as waste
Fresh cooled for direct sale within 5 days in the supermarkets, stores, and hotels	A part goes chilled fresh for direct sale within 5 days in supermarkets or frozen to companies producing chicken nuggets, such as Atiaf and Halawani companies
Communication with suppliers, farm owners, and wholesalers	Communication with the parent company Tetra and wholesalers
Management of accounts	Management of accounts

Customer segments: The clients of the manual slaughterhouses in Qalyubia are hotels and restaurants, supermarkets, and retailers. The slaughterhouses serve the surrounding area. They supply fresh chilled whole chicken as well as chicken parts (breasts, thighs, and fillets) for consumption within 5 days from the date of slaughter.

The semi-automated slaughterhouse in Menoufia supplies its products to supermarkets serving high-end consumers and to manufacturers of processed chicken products. The slaughterhouse produces a variety of products in accordance with international standards, which are delivered on a daily basis to customers in various governorates.

Customer relationships: All slaughterhouses have close relationships with their clients with daily communication on their requests. The prices of various chicken products are set by the Chicken Producers Union, which informs stakeholders through a daily text message. Pricing is based on the market price plus freight, as well as a separate parameter for each poultry product.

Channels: Communication with partners occurs via mobile phones, social media (websites) and in-person visits. Products are delivered in refrigerated vans or trucks.

Cost structure: The purchase of chickens dominates the cost structure accounting for nearly 90 percent of the total costs. Labor costs (casual and permanent) contribute four to five percent of the total slaughterhouse costs (details in the enterprise budget section).

Revenue Streams: Virtually all revenue stems from the sales of slaughtered chickens. Chicken parts provide the main source of revenue, followed by chilled and frozen chicken (details in the enterprise budget section). All payments are made on time- basis according to prior contracts.

4.3.2. Business process

Details of the business process are presented in Figures 4a and 4b.

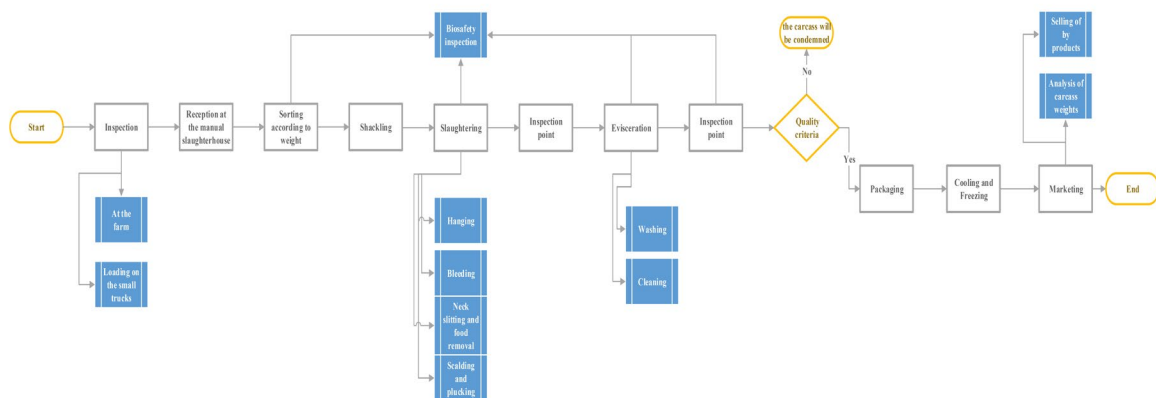


Figure 4a: Business process modelling chart of manual poultry slaughterhouse

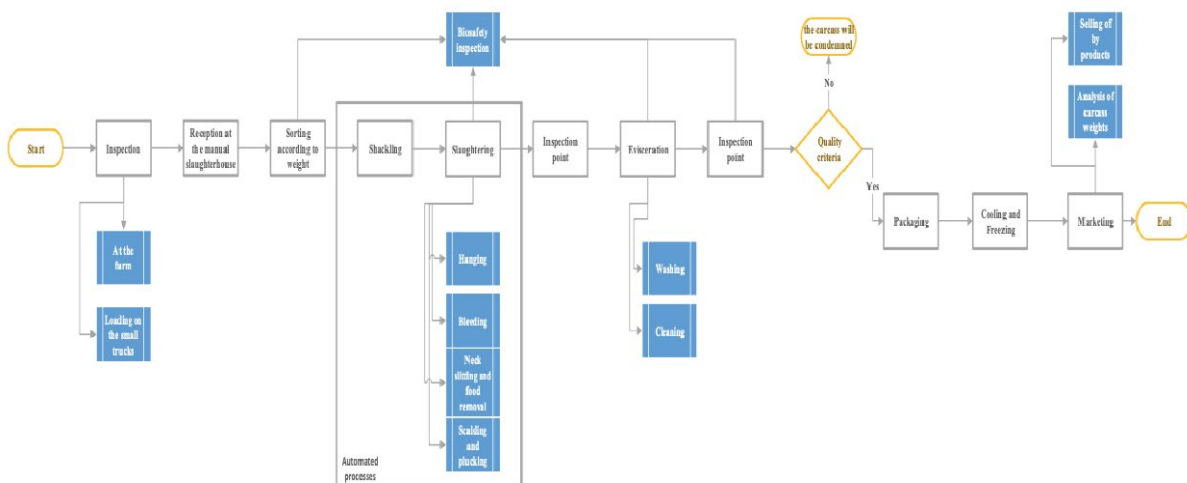


Figure 4b: Business process modelling chart of semi-automated poultry slaughterhouse

Manual slaughterhouses

Sourcing of birds

- The slaughterhouse owner calculates the number of birds to order based on available funds and chicken prices
- The birds are sourced either from a nearby farm or wholesaler through a broker

Pre-slaughter activities

- The slaughterhouse is cleaned and equipment serviced
- Upon arrival, the birds are inspected by slaughterhouse owner

- Birds are sorted by weight

Slaughter and processing

- Chickens are slaughtered according to Islamic law. The process includes the operations of shackling, hanging, bleeding, neck slitting, scalding, and plucking
- Heads and legs are cut and viscera removed and disposed of as waste
- Carcasses are washed and cooled in lukewarm and then cold water
- Chicken are cut, packed and placed into refrigerators

Marketing/delivery & management

- Delivery to customers is carried out in refrigerated vehicles daily or weekly according to order²
- Payment is either effected immediately in cash or based on credit, depending on prior agreements
- Accounts are kept for all activities and transactions

Semi-automatic slaughterhouse

- Tetra Company sends live chickens from its farms to the slaughterhouse

- Additional chickens may be sourced through wholesalers to fill spare capacity

- The slaughterhouse is cleaned and equipment serviced
- Upon arrival the chickens are inspected by the veterinarian appointed by the government veterinary services and sick birds are discarded
- Birds are sorted by weight

- Chickens are slaughtered according to Islamic law. The process includes the operations of shackling, hanging, bleeding, neck slitting, scalding, and plucking
- A veterinarian examines the slaughtered chickens after defeathering; red-breasted chickens are condemned and disposed of
- Heads and legs are cut and viscera removed, and, with the exception of liver and gizzard, disposed of as waste
- Carcasses are washed and cooled in lukewarm and then cold water
- Chicken carcasses pass through a cooling tunnel
- Chicken are cut, packed and placed into refrigerators

- Delivery to customers is carried out in refrigerated vehicles daily or weekly according to order
- All payments from companies are made on a time- basis according to prior contracts with the parent company Tetra that owns the Ashmoun slaughterhouse
- Accounts are kept for all activities and transactions

² Prices paid by restaurants and shops or range between EGP 30 and EGP 31 per kg while hotels pay between EGP 33 and EGP35 per kg.

4.3.3. Enterprise budget

The manual slaughterhouses process around 15 000 birds per month while the semi-automated facility in Ashmoun processes around 40 000 birds per month. Chilled chickens account for more than 98 percent of the revenue generated by the manual slaughterhouses while frozen chicken contributes 54 percent to the revenue of the semi-automated slaughterhouse (Table 7).

Table 7: Annual enterprise budgets of poultry slaughterhouses (EGP 15.7 = USD 1)

Item	District		
<i>Revenue</i>	Banha ¹	Kafr Shokr ¹	Ashmoun ²
Chilled chicken (whole & parts)	13 000 000	12 000 000	14 976 000
Frozen chicken	5 896	6 084	17 424 000
Slaughter wastes	120 000	144 000	11 520
Total Revenue	13 125 896	12 150 084	32 411 520
<i>Variable costs</i>			
Chicken purchase	9 500 000	9 000 000	21 600 000
Disinfectants, detergents & health inspection	400 000	400 000	2 880 000
Casual labour	200 000	288 000	288 000
Electricity	8 000	12 000	21 000
Water	7 800	7 200	60 000
Maintenance	5 000	5 000	5 100
Chicken delivery	5 000	10 000	86 400
Total variable costs	10 125 800	9 722 200	24 940 500
Returns over variable costs	3 000 096	2 427 884	7 471 020
<i>Fixed costs</i>			
Permanent labour	220 000	180 000	720 000
Taxes	2 000	2 000	5 000
Depreciation of building (@5%)			750 000
Depreciation of equipment (@10%)			500 000
Total fixed costs	222 000	182 000	1 975 000
Total costs (variable & fixed)	10 347 800	9 904 200	26 915 500
<i>Indicators</i>			
Returns over total costs	2 778 096	2 245 884	5 496 020
Profit/bird	13.8	11.8	12
Net profit margin (%)	21.2	18.5	17.0
Fixed costs/revenue (%)	1.7	1.5	6.1

¹ Manual, 500 to 550 birds/day; ² semi-automated, 1,500 birds/day

For all three slaughterhouses, fixed costs account for two to three percent of the total costs. The purchase of chicken is the major expense, constituting around 93 percent of the variable costs of the two manual slaughterhouses and around 87 percent of the variable costs of the company-owned semi-automatic slaughterhouse. The cost of disinfectants, detergents and poultry inspection accounts for around four percent of the variable costs of the manual slaughterhouses, while this figure is 12 percent

for the semi-automated slaughterhouse. The net profit margin of all three slaughterhouses is in the range of 20 percent.

4.3.4. Biosecurity and public health practices

Unlicensed manual slaughterhouses have been established in villages during the current period and potentially contribute to the spread of diseases as they violate a number of basic biosecurity measures. The main violations of the manual slaughterhouses comprise:

- Location within residential blocks;
- Poor condition of buildings and equipment making cleaning and disinfection difficult;
- Purchase and processing of dead and sick chickens because they are cheap and provide higher profits and returns;
- Dumping of poultry waste on to streets turning into piles of garbage;
- Lack of sufficiently trained, experienced and competent workers.

The semi-automated slaughterhouse implements the following measures to safeguard animal and public health:

- A government veterinarian is present during all operations;
- Chicken samples are taken and analyzed at the Animal Health Research Institute weekly to obtain ISO.
- Smears are taken from the tables and the hands of workers and analyzed;
- Sick poultry is destroyed;
- Injured or dead chickens are disposed of in the waste and given to a waste collector;
- Slaughterhouse workers have a health certificate and receive regular health checks;
- Health certificates are renewed annually;
- Workers receive health insurance;
- Before entering the slaughterhouse, the workers' temperature is taken and, since the emergence of COVID-19, workers pass through a sterilization corridor at the entrance;
- Workers wash their hands, change clothes (which are washed daily in the slaughterhouse's laundromat), and wear a headcover, mask, and gloves (rings, jewelry, watches, and headscarves are strictly prohibited);
- Workers disinfect their shoes in the sterilization basin before entering the production hall (the water of the sterilization basin is changed three times per day);

4.4. Poultry retail

In rural areas, many residents refuse to buy slaughtered chilled or frozen chicken as they believe that the chicken may have been dead or sick before slaughtering. Retailers, therefore, sell live birds and slaughter them on site in the presence of the customer.

In most cases, the retailer's shop is located within a residential area. Many of the retailers in the region have been engaged in the business, often a family enterprise, for a long time. They do not only trade chicken but also other types of poultry such as ducks, geese, turkey, and pigeons, as well as rabbits. In villages and peri-urban areas, retailers often do not have slaughter permits, commercial register, or tax card. Therefore, most of them don't have access to bank loans.

Medium sized stores in rural areas sell about 70 to 80 chickens per day. Larger stores, especially those in cities, may sell between 300 and 400 chickens per day. The purchase price varies by day, ranging between EGP 20 and 22 per kg, while the sale price normally lies between EGP 29 to 30 per kg.

4.4.1. Business model canvas

Value propositions: The retailer provides consumers with safe chicken and other poultry meat for preparation.

Key partners: Retailers receive live poultry from wholesalers and sell these to end consumers while at the same time offering the service to slaughter and prepare the birds as required by the customer.

Key resources: Retailers commonly rent a shop equipped with cages, tools, a defeathering machine, a boiler and a refrigerator.

Key activities: The key activities are listed in Table 8. More details are provided in the 'business process' section.

Table 8: Key activities at the retail node

Activity	Frequency
Contacting the wholesaler to order the quantity of chickens needed	Daily
Purchase of chicken feed	
Cleaning of chicken cages, water and feed troughs, equipment, machine and floor	Twice per day, before opening and after closing
Attending customers in shop or via phone	During the day
Slaughter and preparation of selected chicken(s) according to customers' requests	
Delivery of orders to customers requesting home delivery	
Management of accounts	
Receiving chickens from the wholesaler	At night or early in the morning
Weighing chickens and placing them in the cages	
Putting water and feed in the cages	

Customer segments: Clients mainly live in the surrounding area. Sometimes restaurants, barbecue shops, grills, and hotels from the region buy chicken from retailers.

Customer relationships: The relationship between the retailer and wholesaler has developed over many years and is considered one of the strongest relationships in the poultry value chain. The relationship is based on mutual trust. By contrast, the relationship with restaurants is weak.

Channels: Communication with wholesalers occurs through mobile phone or direct contact. Information about prices is obtained through the internet but the price is usually determined by the wholesaler. Customers pay for the chickens in cash upon receipt.

Cost structure: The purchase of chicken accounts for 97 percent or more of the variable costs, which in turn account for 95 to 99 percent of the total enterprise costs. Labor costs (casual and permanent) contribute between one and six percent of the total costs of the business (details in the enterprise budget section).

Revenue streams: Revenue is obtained from the sales of slaughtered chickens and in some cases also from the sale of slaughter wastes. Customers pay for the chickens in cash upon receipt ensuring a steady revenue stream.

4.4.2. Business process

Details of the business process are presented in Figure 5.

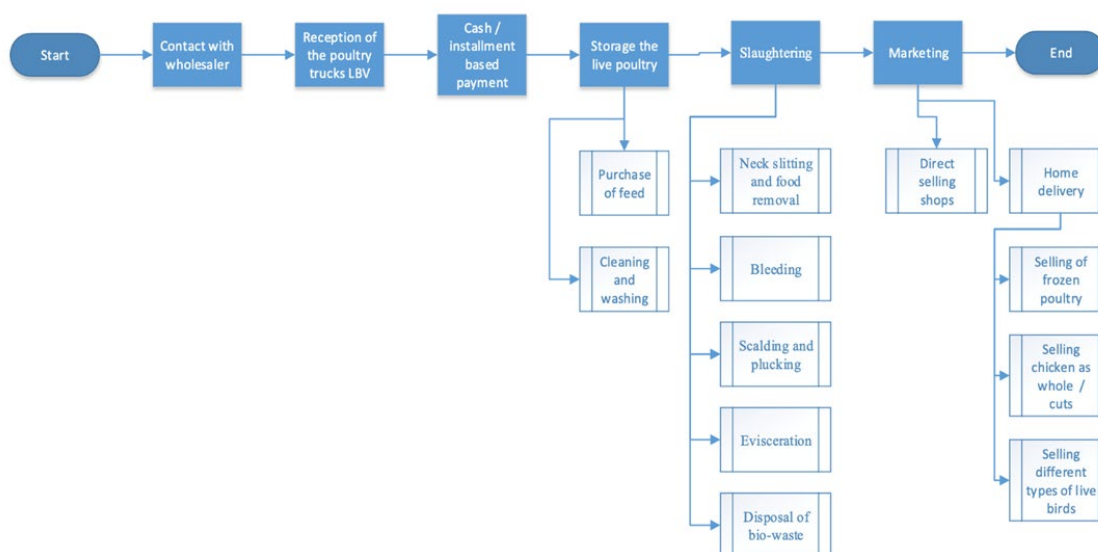


Figure 5: Business process modelling chart of poultry retail

Prior to or after business hours

- The retailer contacts the wholesaler for the price of chicken, indicates the quantity required and, if agreement is reached, orders a batch.
- The bird cages and water and feed troughs are cleaned
- The poultry are delivered either very early in the morning (5 am) or in the evening (7 pm) to avoid the high temperatures, particularly during the summer.
- The chickens are weighed, placed in cages and provided water and feed.
- The shop is cleaned and opened for customers
- The retailer manages accounts.

During business hours

- Customers select the live chicken, which is then slaughtered, defeathered, and eviscerated. The head and legs are removed, and the body is washed, cut according to the consumer's request, packed and handed to the customer.
- Sometimes birds are slaughtered for the preparation of deboned meat.
- Chicken parts, which have not been sold, are stored in the refrigerator for the next day.
- Slaughter waste is filled into plastic bags
- The retailer managed daily accounts.

4.4.3. Enterprise budget

The two retailers in Menufia sold between 700 and 800 birds per month while those in Qalyubia sold around 3 000 birds per month. Consequently, revenues and costs of retailers were around four times higher in Qalyubia than in Menufia (Table 9). The two large retailers have annual net profits of EGP 444 000 and EGP 425 000, while the two small retailers make an annual profit of EGP 23 000 and

35 000, respectively. In addition to the revenue from sold birds, the two large retailers receive close to six percent of their revenue from the sale of slaughter wastes.

For the two large retailers, the cost of purchased chickens accounts for 99 percent of the variable costs while for the two smaller retailers chicken purchases account for 97 percent of the variable costs. The two smaller operators have comparatively higher fixed costs, 3.8 and 5.2 percent vs. around one percent for the large retailers. The two smaller operators also have higher relative labour costs (casual and permanent), amounting to 3.7 and 5.2 percent of total costs, than the larger retailers (1.0 and 1.3 percent).

The net profit margin of the two large retailers is 25 percent while the small retailers have a profit margin of five and seven percent, respectively.

Table 9: Annual enterprise budgets of poultry retailers (EGP 15.7 = USD 1)

Item	District			
<i>Revenue</i>	Banha	Kafr Shokr	Ashmoun	Quesna
Chicken sales	2 084 544	2 002 560	449 328	515 200
Waste sales	128 000	124 000		
Total Revenue	2 212 544	2 126 560	449 328	515 200
<i>Variable costs</i>				
Chicken purchase	1 737 120	1 668 800	390 400	448 000
Casual labour	10 800	9 600	12 000	9 204
Gas & electricity	1 600	1 600	1 300	3 800
Water	1 000	1 180	696	740
Maintenance	600	600	300	300
Total variable costs	1 751 120	1 681 780	404 696	462 044
Returns over variable costs	461 424	444 780	44 632	53 156
<i>Fixed costs</i>				
Permanent labour	12 000	7 200	12 000	8 600
Rent	5 400	12 000	9 800	9 600
Taxes	200	200	250	250
Total fixed costs	17 600	19 400	22 050	18 450
Total costs (variable & fixed)	1 768 720	1 701 180	426 746	480 494
<i>Indicators</i>				
Returns over total costs	443 824	425 380	22 582	34 706
Profit/bird	12.07	12.04	2.73	3.66
Net profit margin (%)	25.09	25.00	5.29	7.22
Fixed costs/revenue (%)	0.80	0.91	4.91	3.58

4.4.4. Biosecurity and public health practices

Most of the retailers do not follow even minimum biosecurity and public health practices, which can be attributed to cultural factors and the lack of government control through the veterinary department and local authority.

- The stores are in poor condition, dirty and smelly due to poultry wastes.

- Most of the stores only have one container for boiling water and one basin for washing chicken, which are not regularly cleaned in the course of the day.
- Shops are not regularly inspected by the veterinary department.
- Workers neither have health certificates nor health insurance.
- There are no any precautionary health measures for workers who work for retailers.
- Most stores that sell live poultry throw their waste next to the store or into the middle of the road.

5. Discussion and conclusions

Poultry businesses at the different nodes of the value chain are all profitable, with profit per bird ranging from about EGP 3 to 4 for wholesalers and small retailers to between EGP 23 and 33 for broiler producers. The profitability of the enterprise, that is the profit margin or the percentage of sales that represent profits, is high for producers (41 to 52 percent), large retailers (25 percent) and manual slaughterhouses (19 to 21 percent), while is low for wholesalers (7 to 9 percent) and small retailers (5 to 7 percent). In general, low profit margins are expected for businesses such as retail and wholesale, for which the high turnaround drives revenue and profit; conversely, profit margins are high for businesses with lower sales, such as for producers. As a rule of thumb, a 10 percent profit margin is acceptable, a 20 percent profit margin is good, while a 5 percent profit margin is poor. The overall profit for the different poultry business is relatively high compared with the average Egyptian salary of about EGP 10 000 per month. Small retailers are the only exception, but their business includes more than the sale of live poultry. Roughly, the differences between the farm gate purchase price and the price paid by the consumer for a dressed bird is about 15 EGP or slightly more.

Table 10: Summary of monthly poultry production/turnover and financial indicators of the four value chain nodes (number of observations)

Node	Birds/ month (1,000)	Profit/ bird (EGP)	Profit/ Month (1,000EGP)	Profit margin (%)	Fixed costs/ revenue (%)	Av. salary / profit per month (%)
Producer (12)	2.1 – 2.5	22.9 – 33.2	57 – 69	41.1 – 52.0	0.8 – 1.2	17.5 – 14.5
Wholesaler (12)	19.8 – 40.1	2.9 – 3.8	72 – 116	6.6 – 8.6	0.02	13.8 – 8.6
Slaughterhouse						
Manual (2)	15.9; 16.7	11.8; 13.8	187; 232	18.5; 21.2	1.5; 1.7	5.3; 4.3
Semi-aut. (1)	38.1	14.8	562	17.0	6.1	1.8
Retailer						
Small (6)	0.7; 0.8	2.7; 3.7	2; 3	5.3; 7.2	3.6; 4.9	500; 333
Large (6)	2.9; 3.1	12.0; 12.1	35; 37	25.0; 25.1	0.8; 0.9	28.6; 27.0

Given the low fixed costs for all businesses, there are potentially low barriers to entry and exit in all poultry businesses, which should ensure competition and possibly low prices for consumers. However, wholesaling / transporting is a “specialized” business, as it is largely based on personal connections. On the other hand, wholesalers are also taking the lowest risk as they select the birds before purchase and resell them within few hours. Limited competition at this node of the value chain could therefore make the emergence and growth of medium to small size poultry operators difficult.

Chicken breeders and retailers said that the offices of so-called "brokers" control the prices. Brokers link the farm owners with the wholesalers in exchange for a commission. They set the farm gate purchase price as well as the trading prices, which may be slightly different depending on the cost of transportation, the cost of labour and the rental rates, which vary by area.

A major issue is that, in many cases, poultry businesses are not complying with existing rules and regulations on biosecurity and food safety, which creates a number of public health threats (see Annex 3 for a list recommended biosecurity practices by node of the poultry value chain). There are likely two underlying reasons for this. On the one hand, the government is unable to provide sufficient guidance and enforce penalties on chain actors not complying with the existing legislative framework. On the other hand, business owners often perceive the adoption of biosecurity and food safety practices as a net cost. Yet, in many cases, adoption of these practices is a relatively low-cost investment with good returns for the enterprise: for example, changing clothes before entering the broiler house or ensuring that no visitors enter the broiler house can significantly reduce mortality in birds, thereby increasing profitability. Of course, some actors might have less incentives to adopt good practices, such as wholesalers / transporters who receive little returns from regularly disinfecting vehicles and cages.

Current profitability levels are likely to generate a sufficiently high debt servicing coverage ratio for most businesses to permit access to a loan and adopt biosecurity practices that make their business more sustainable. However, most poultry businesses are informal, which makes it a challenge for them to access finance while, as noted above, some businesses might have limited or no incentives to adopt certain biosecurity practices.

We suggest a three-pronged approach to facilitate a sustainable growth and transformation of the poultry value chain from a public health perspective. First, poultry businesses should be consulted to assess what would be the impact on profitability of the adoption of key biosecurity practices. The objective of this consultation would be to generate consensus among stakeholders on the benefits that the adoption of biosecurity practices could generate for their businesses. Second, micro-finance and finance institutions should be consulted to assess the bankability of the different businesses and identify actionable options to provide loans to informal poultry businesses, such as group lending schemes or the creation of rotating savings and credit associations (ROSCAs). This could allow poultry businesses to access finance to start adopting key biosecurity practices. Third, the government should use its limited resources to mainly check and monitor the behaviour of those stakeholders, such as transporters, who might have limited incentives to comply with existing laws and regulations of biosecurity practices.

While the existing poultry value chain generates benefits for poultry operators and consumers, it also creates major public health threats because of limited compliance with key biosecurity and food safety practices. A public-private partnership involving poultry businesses, finance and micro-finance institutions and the government could facilitate a sustainable growth and transformation of the poultry sector in the medium to long-term, which generates income and livelihoods along the value chain, a steady supply of affordably priced meat for consumers and little if any public health risks for society.

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Annex 1: The Business Model Canvas and Business Process Modelling

The Business Model Canvas (BCM) is a strategic management and lean startup template for documenting existing business models. It is a visual chart with elements describing an enterprise through value proposition, infrastructure, customers, and finances. It assists firms in aligning their activities by illustrating potential trade-offs. The below chart reflects the dynamic of the nine blocks:

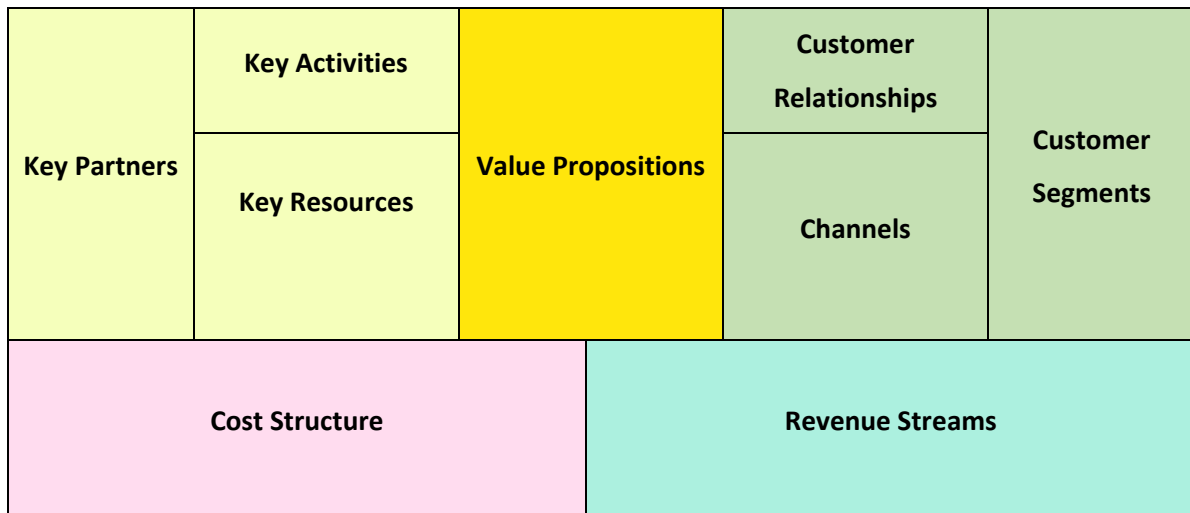


Figure A1: Business Model Canvas

The CANVAS reflects the integration among the following key factors:

- **Key Partners:** Buyers and suppliers' relationships.
- **Key Activities:** The most important activities performing by the company.
- **Key Resources:** Assets that the company needs to sustain and support the business (human, financial, physical, and intellectual).
- **Value Propositions:** The products and services offered to meet the needs of customers.
- **Customer Relationships:** The firm has to identify the form of relationship they want to build with their customers.
- **Channels:** The firm can reach its clients through its different channels.
- **Customer Segments:** Different types of customer segments.
- **Cost Structure:** The business model focuses on minimizing costs by creating value for products and services.
- **Revenue Streams:** The firm makes money from each customer

Business process modeling (BPM) in business process management is the activity of representing processes of an enterprise, so that the current process may be analyzed, improved, and automated. The business objective is often to increase process speed or reduce cycle time; to increase quality; or to reduce costs, such as labor, materials, scrap, or capital costs. In practice, a management decision to invest in business process modeling is often motivated by the need to document requirements for an information technology project.

Annex 2: DOC and Broiler Production Capacity

Table A1: DOC production capacity 2018 by governorate

Governorates	الطاقة الكلية (مليون بيضة) Full capacity (million egg)	عدد الماكينات Num. of hatchers	عدد المعامل Num. of laboratories	المحافظات
Alexandria	43.815	29	6	الإسكندرية
Behera	210.519	182	23	البحيرة
Gharbia	156.211	153	46	الغربية
Kafr El Sheikh	7.927	18	7	كفر الشيخ
Dakahlia	216.500	175	37	الدقهلية
Damietta	32.799	36	8	دمياط
Sharkia	512.616	393	76	الشرقية
Ismailia	22.673	27	4	الإسماعيلية
Port Said	0	0	0	بورسعيد
Suez	0	0	0	السويس
Menoufia	243.765	175	11	المنوفية
Kalyoubia	231.348	296	62	القليوبية
Cairo	47.840	26	1	القاهرة
Lower Egypt	1726.013	1510	281	الوجه البحري
Giza	124.968	134	13	الجيزة
Beni Suef	3.876	6	2	بني سويف
Fayoum	71.970	84	11	الفيوم
Menia	40.635	48	13	المنيا
Middle Egypt	241.449	272	39	مصر الوسطي
Assuit	27.346	46	18	أسيوط
Suhag	8.945	14	7	سوهاج
Qena	6.696	7	2	قنا
Luxor	14.321	21	4	الأقصر
Aswan	0	0	0	أسوان
Upper Egypt	57.308	88	31	مصر العليا
Matrouh	0	0	0	مطروح
Noubaria	371.470	292	23	النوبارية
North Sinai	11.750	18	5	شمال سيناء
South Sinai	0	0	0	جنوب سيناء
New Valley	0	0	0	الوادي الجديد
Red Sea	7.834	12	1	البحر الأحمر
Out of Valley	391.054	322	29	خارج الوادي
General Total	2415.824	2192	380	إجمالي الجمهورية

Source : Economic Affairs Sector.

المصدر : قطاع الشؤون الاقتصادية.

Table A2: Broiler production capacity in 2018 by governorate and farm size class

Governorates	الجملة Total	مزارع ١٠٠ ألف فأكثر Farms 100 thou. and more	مزارع ٢٥ ألف إلى أقل من ١٠٠ ألف Farms 25 thou. to less than 100 thou.	مزارع ٥ آلاف إلى أقل من ٢٥ ألف Farms 5 thou. to Less than 25 thou.	المحافظات
Alexandria	12354.600	6015.800	5737.200	601.600	الاسكندرية
Behera	61615.200	24800.000	29226.000	7589.200	البحيرة
Gharbia	119612.701	77379.628	35696.323	6536.750	الغربية
Kafr El_sheikh	29337.730	4821.650	19275.210	5240.870	كفر الشيخ
Dakahlia	64690.054	13877.970	45315.509	5496.575	الدقهلية
Damietta	12545.000	3945.000	7688.000	912.000	دمياط
Sharkia	114328.090	35876.830	67082.480	11368.780	الشرقية
Ismailia	17926.700	14023.000	3663.200	240.500	الإسماعيلية
Port Said	280.500	0	247.000	33.500	بورسعيد
Suez	237.150	58.500	138.300	40.350	السويس
Menoufia	16685.000	4192.000	11240.000	1253.000	المنوفية
Kalyoubia	51486.000	8967.000	40285.000	2234.000	القليوبية
Cairo	3367.000	3265.000	102.000	0	القاهرة
Lower Egypt	504465.725	197222.378	265696.222	41547.125	الوجه البحري
Giza	10563.450	4165.000	6169.000	229.450	الجيزة
Beni Suef	7915.000	2520.000	5246.000	149.000	بني سويف
Fayoum	15726.200	3307.000	8683.700	3735.500	الفيوم
Menia	26152.000	1970.000	18483.000	5699.000	المنيا
Middle Egypt	60356.650	11962.000	38581.700	9812.950	مصر الوسطي
Assiut	10796.500	1050.000	5069.500	4677.000	أسيوط
Suhag	9657.863	175.000	5305.457	4177.406	سوهاج
Qena	3365.930	403.280	1080.800	1881.850	قنا
Luxor	1710.000	100.000	1610.000	0.000	الأقصر
Aswan	51.800	0	30.000	21.800	أسوان
Upper Egypt	25582.093	1728.280	13095.757	10758.056	مصر العليا
Matrouh	14504.000	1551.500	12888.900	63.600	مطروح
Noubaria	75328.038	68887.859	5892.381	547.798	النوبارية
North Sinai	7262.580	2212.600	5000.480	49.500	شمال سيناء
South Sinai	237.000	0	70.000	167.000	جنوب سيناء
New Valley	2116.000	0	1451.000	665.000	الوادي الجديد
Red Sea	329.300	121.000	191.300	17.000	البحر الأحمر
Out of Valley	99776.918	72772.959	25494.061	1509.898	خارج الوادي
General Total	690181.386	283685.617	342867.740	63628.029	إجمالي الجمهورية

Source : Economic Affairs Sector.

المصدر : قطاع الشؤون الاقتصادية .

Annex 3: Recommended biosecurity practices for poultry operators

Recommended biosecurity practices for broiler farms

1. Siting of farms and bio-exclusion

Poultry farms must be constructed at a safe distance from neighbouring farms, public roads and waterways, meaning that they are places where there is the greatest possible isolation from the sources of infection (neighbouring farms, migratory birds, slaughterhouses, hatcheries, vehicles transporting poultry production requirements).

Poultry farms should be aware of the following requirements:

- The farm must be surrounded by a strong fence with a single gate, which is permanently closed with a sign to prevent entry.
- The distance between broiler farms should not be less than one kilometre.
- Water sources and feed must be free of pathogens.
- Vehicles must be washed and disinfected before they are allowed to enter the farm.

2. Regulation of human access

For individuals (workers, supervisors and visitors) there must be special clothes and shoes, and visits to the farm are not allowed except after showering and changing clothes.

- Workers inside a chicken house are not allowed to move from one chicken house to other chicken houses.
- The farm must keep records of visitors to the farm, dates of visits, names of people, in the event of a disease outbreak requiring investigation.
- Put signs on the entrances stating that no entry is permitted. Doors must be kept locked and the keys kept in a safe place.
- Foot baths at the entrance to the farm and the wards.
- The farm workers must periodically undergo a medical check.

3. Protection of birds

- Avoid mixing different types and ages and avoid crowding of birds.
- Remove dead birds from the barns twice a day and remove and slaughter sick birds.
- Only stock farm with chicks free from vertically transmitted diseases.

4. Cleansing

- With the exit of the last chicken from the ward, spraying of an effective insecticide on the mattress.
- Remove the sawdust from the chicken house and take it out of the farm for a long distance.
- Removing light bulbs - hoods and hanging wires for heaters - fans.
- Wash the ward with regular water, and add detergent or soap if necessary.
- After that, the chicken house is closed, sterilized by fumigation with formalin and potassium permanganate, and left for 24 hours, then the curtains are opened for ventilation.
- Disinfection of equipment and utensils with appropriate compounds.
- Allow the amber to dry out and the sun to enter after disinfection to control diseases.

5. Production equipment and feed

- The chicks must be transported from the hatcheries in cartons designated for single use which are then burned. In the case of using plastic cages, they must be washed and disinfected before and after use.
- Do not bring eggs from other farms into the farm for the purpose of consumption.
- Keeping the feed in closed containers and store it in clean and sealed rooms with regular removal of the feed residues on the ground.

6. Waste

- Dead birds must be burned and buried so that they do not attract insects and other animals.
- Every poultry farm must have a crematorium designated for disposal of dead birds by burning and burial.
- Dead birds and spoiled eggs are to be buried in designated cemeteries within the farm's premises.
- Garbage must be burned in a specific place on the farm.

7. Vaccination

Vaccination is an important supportive aspect of biosecurity. Some vaccines confer good immunity, but at the same time they may elicit a strong and severe reaction of the flock and may lead to the manifestation of other diseases.

- Birds should be vaccinated against the major poultry diseases prevalent in the area.
- To achieve best results, vaccination should be carried out at the right time and using the correct dose and means of application.
- Periodic serological tests should be carried out on random samples to ascertain the level of the flocks' immunity.
- The results should be kept in easily accessible records.

Recommended biosecurity practices for poultry wholesale

- Choosing healthy, disease-free chickens by inspecting the farm before purchase.
- Wash transport vehicle and cages after every poultry distribution process to retailers.
- Disinfect the cages with strong disinfectants and expose them to the sun.
- Disinfection of workers' clothes and shoes before they enter the farm to load the chickens.
- Only transfer 5 to 6 chickens at one time from the farm to the cages.
- Chickens that died during the transport process must be disposed of in a crematorium or safely buried.
- Chickens that have not been sold must be kept in isolation and not mixed with other farm chickens.
- Chickens injured during packing must be separated from the flock.
- The purchase must be cancelled if any diseases symptoms appear in the flock.
- Spaces must be left between the transport cages for ventilation.
- Cages should be covered with tarpaulin, especially at the front of the car, to prevent airflow.
- The vehicle loaded with birdcages must not stop on the road for any reason. If the vehicle malfunctions, the cages should be immediately transferred to another vehicle.

Recommended biosecurity practices for poultry slaughterhouses

For the semi-automatic slaughterhouse of Ashmoun, it was found that it follows all health and biosecurity procedures, but manual slaughterhouses need to implement higher biosecurity through the following:

- A veterinarian specialized in examining live poultry should be present to ensure that they are free from pathological manifestations and deformities, as well as examining slaughtered poultry to ensure that they are free from pathological manifestations, deformities, and any other defects that make them unfit for human consumption.
- Provision of hot and cold drinking water in sufficient quantities, ensuring its distribution to all manufacturing lines.
- Partitions between the stages of the slaughter process.
- Ventilation and good lighting in all sections of the slaughterhouse.
- Provision of facilities for cleaning and disinfection of vehicles used for transporting birds.
- Provision of sufficient quantity of sprays used in the daily washing and disinfection process.
- Daily disposal of offal.

Recommended biosecurity practices for poultry retail

- Workers must have health certificates approved by the Ministry of Health.
- Periodical renewal of health certificates.
- Wash and disinfect the shop every day.
- Cleaning and disinfection of slaughter tools.
- Safe disposal of dead and sick chickens.
- Only accept healthy chicken free of disease from the wholesaler.
- Not selling sick chickens to customers.

