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Analysis Of The Cost Of Egg Production: A Case Study On A Family Property

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Abstract: *The analysis of production costs is essential to outline strategies and for companies to remain in the market. The present study aims to verify the number of dozens of eggs needed to cover all production costs on a family farm. To answer the research problem and meet the proposed objectives, the methodology used was qualitative and quantitative, with the objectives being characterized as exploratory and descriptive research, and the procedures as a case study and bibliography. Data were obtained through an on-site visit to the family farm, located in the municipality of Santa Helena - PR. After analyzing the data, the break-even point was calculated to determine how many dozen are needed to pay all production costs in a batch of 16,000 birds. Thus, it was found that with the sale of 7,687 cartons containing 30 dozen eggs, that is, 230,610 dozen, the owner will pay all production costs. It is concluded that the activity is profitable and the return is greater because it is a family farm, and all expenses for a production plot, which corresponds to one year, will be paid in the sixth month.*

Key Words: *Egg production; Production cost; Equilibrium Point.*

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I. Introduction

To remain competitive in the market, companies need to devise strategies. One of them is cost analysis aiming at cost reduction to increase profits. However, cost reduction should not compromise product quality to avoid affecting sales and prompting customers to switch to similar alternatives. Family producers seek diversification in their activities to increase income, with egg production being among the various ventures they engage in.

Accounting plays a crucial role in maximizing returns from egg production. By gathering relevant information, the owner can implement controlled planning of all expenses and costs, ensuring profitable sales without incurring losses. This way, monthly debts can be settled without concerns about the unit costs of each dozen of eggs.

Initiating the egg production process requires careful planning of facilities to provide comfort and protection against poultry predators, thereby offering better handling conditions and productivity[19]. To keep their product in the market, egg producers must comply with regulatory requirements. Due to high competition, they often face devaluation of their product, as merchants pay a considerably low price[17]. By analyzing the data, the producer can project their profitability and determine the minimum price at which they can sell their product to cover production costs.

A study points out that the lack of control hampers better profitability on rural properties, emphasizing the need for performance-oriented control tools[27]. Thus, this research aims to address the following question: What quantity of dozens of eggs is necessary for the family producer to cover costs and expenses and remain in the market? The overall objective is to determine the quantity of dozens of eggs required for the producer to cover costs and expenses on a family farm. To achieve this goal and address the research problem, the specific objectives guiding this study are: Identifying the production methods in the studied property; Assessing direct and indirect production costs; Determining the animals' lifespan in the production process; and analyzing the production's break-even point and contribution margin. Then, a case study was conducted on a family property located in Santa Helena, Paraná, Brazil. The data analysis employed qualitative and quantitative methods, characterizing the objectives as exploratory and descriptive research. This research holds significant importance as it not only assists producers but also aids potential investors in this area by detailing production costs and potential profitability.

II. Theoretical Framework

In this section, we present the theoretical framework related to the theme studied in this article. It encompasses the concepts and definitions of the proposed subject, including accounting, cost accounting, family farming, agricultural accounting, and poultry farming.

Cost Accounting

The entire operational procedure for obtaining accounting information is carried out through analyses of data collection, based on monthly, quarterly, or annual billing, with these data being appraised to assess the financial health of the entity[14]. The data collected within the period must be included in the financial reports, with cost accounting being a set of these records aimed at measuring the actual expenses of the organization's products or services[21]. All costs and expenses for the period need to be properly separated to ensure correct allocation in the final product[18].

The choice of each cost method aims to provide quality and accuracy in the data collected so that, with this information, the company's manager can determine the real value of the costs of their products[22]. The expenses for the period involve the entire process of commercializing goods, the need for investments in logistics and marketing to promote product recognition in the market[18]. Every product must have a profit margin, and every entrepreneur aims to achieve it in their production. Thus, when market prices are very low to avoid excessive losses, one solution would be product storage and waiting for price recovery[7].

When starting a venture, all potential expenses must be considered from the beginning of productivity, such as raw materials, transportation, labor, among others. All these collected data are essential for the entity to prepare for the commercialization of its products in such a competitive market[18].

In production, for correct profit calculation and analysis of costs and expenses, these need to be classified as variable costs and expenses or fixed costs and expenses. Variable costs and expenses are those that vary with production volume[6]. On the other hand, fixed costs and expenses do not tend to vary with production volume, as their costs are fixed and monthly. These values are added to the final product[21]. The classifications of fixed and variable costs form the basis for calculating the breakeven point, which demonstrates how profit can be affected by costs, showing the quantity the company needs to sell to cover all expenses. In other words, the breakeven point is defined as the moment when total revenues are exactly equal to total costs and expenses, resulting in zero profit[6].

Another point analyzed is the contribution margin, which corresponds to the remaining amount of sales revenue after deducting variable costs. When the unit price is subtracted from the unit cost, we get the unit contribution margin[21]. Therefore, accounting, together with cost accounting, has aided owners in collecting data to verify the final cost values of their products. This information allows owners to set selling prices that cover expenses and generate financial returns[26].

As with other fields of activity, accounting, in conjunction with agriculture, assists farmers in decision-making through the collection of information and the preparation of reports[5].

Agricultural Accounting

Similar to general accounting, agricultural accounting utilizes classifications. In agriculture, there are what are known as extraordinary or involuntary losses that can occur due to high temperatures, frost, storms, among others[18]. Agribusiness is an example of how agriculture is becoming a reference for domestic trade and exports. Planning is a key component for farmers seeking assured returns on their investments[11].

Agricultural accounting analyses the means by which farmers can recover the fixed assets, that is, the value invested in the property. The values recorded in fixed and intangible assets need to be readjusted to include a percentage for depreciation and amortization[18].

With accounting and agriculture going hand in hand, farmers have the opportunity to analyze revenues and expenses throughout the process, through the preparation of financial statements. And with this wealth of data, both agriculture and the industrial sector have excelled and generated significant advances in the financial sector[13].

Family Farming

Family farming is important in the economic scenario of Brazil, contributing to rural development with family progress and sustainable growth[1]. Amidst the rise of capitalism, agriculture is responsible for a significant portion of job creation and financial income. Small family farmers, who rely on family labour, depend on agriculture for their livelihood[13].

The small-scale farmers supply raw materials to industries. Family farming is responsible for supplying agricultural cooperatives and accounts for 25% of national production. Small farmers stand out in the Brazilian scenario for their strength and productivity[1]. Although responsible for a significant portion of food production, family farming consists of small properties primarily focused on providing sustenance for the family[20].

The process of modernization has a broad scope and does not only benefit farmers; it also contributes to the country's economic development. With technological advances, small farmers who lacked financial resources to keep up with progress had to sell their properties to larger farmers[13].

In the development of production, various procedures must be followed to ensure efficiency and the quality of the final product. The entire process involves stages, from the initial purchasing phase to product storage, resulting in expenses for qualified labour and transportation means[28].

Family farming, with the aim of achieving greater profitability, diversifies its production. According to Santos (2001), in poultry farming and egg production, the supply of feed is a critical factor responsible for a significant portion of production costs, as well as providing the necessary nutrients for animals to produce with quality. The author also highlights that the feed industry injects an amount equivalent to 13 billion Brazilian reais into the Brazilian economy.

Poultry Farming

The advancement of technological innovations during the industrial revolution and the growth of the poultry farming sector have had a positive impact on job creation[25]. The poultry industry has experienced significant growth in recent years, exerting a noteworthy influence on Brazil's economy. Its importance is evident in its contribution to the Gross Domestic Product (GDP), egg exports, and the external market[24].

In egg production, farmers must provide appropriate housing facilities for the birds, ensuring a climate-controlled environment or an ambient temperature that does not exceed 25°C, thereby promoting higher productivity and animal survival[19].

Technological innovations have enabled farmers to achieve greater profitability in production, with egg production becoming a crucial source of income for many families, generating direct or indirect employment opportunities. Consequently, this market has been gaining prominence within the agricultural sector each year[25].

Farmers need to exercise caution when selecting the location for constructing poultry housing facilities, ensuring that it benefits not only the farmer but also the animals that will be housed in the structure[19].

For homeothermic animals, any changes in temperature can impact their comfort range, and alterations in body temperature can lead to reduced productivity. Temperature management is of paramount importance to provide comfort to the animals and subsequently enhance their productivity for efficient cycles[12]. A well-ventilated location with appropriate temperatures fosters higher productivity, prolongs the animals' lifespan, and reduces electricity costs, as the environment created is ideal for the birds' temperature needs[19].

Throughout the process of installing a poultry house for laying hens, essential infrastructure and technologies are required to improve production. However, successful poultry production is not solely dependent on technological equipment. In addition to temperature management, access to quality and abundant water is indispensable, considering that the animals consume twice as much water as they do feed[19].

Water provides essential nutrients for all animal species. It is widely recognized as vital for life generation and maintenance. Apart from its nutrient content, water is critical for maintaining stable animal temperatures, as high consumption can significantly reduce the animals' temperature. Moreover, water is used for administering vaccines and medications[8].

In conclusion, this study aims to determine the quantity of eggs necessary to cover all costs on a family-owned property. Subsequent sections will outline the research methodology and analysis.

III. Methodological Procedures

This research is categorized as an exploratory and descriptive study based on its objectives. Exploratory research, particularly when conducted through bibliographic analysis, aims to gather in-depth information about a specific subject, facilitate the delimitation of the research topic, and formulate research objectives or hypotheses[2].

The exploratory nature of this research lies in its intent to analyze the production process of a family-owned poultry farm primarily engaged in egg sales. The descriptive aspect stems from the purpose of detailing the production process of the property. The technical procedure employed in this research involves bibliographic research and a case study. The bibliographic research seeks to address the research problem using theoretical references found in published documents. It can be conducted independently or as part of a descriptive or experimental research[9].

The case study was chosen due to the examination of a family-owned property situated in the district of São Roque, within the municipality of Santa Helena, State of Paraná, Brazil. The study aims to analyze production costs and ascertain the break-even point, i.e., the number of eggs that need to be sold to cover all production costs. Additionally, it is classified as a bibliographic study, as it draws on existing bibliographic sources related to the topic.

Regarding the research method, a combination of qualitative and quantitative data was utilized to gain comprehensive insights and comprehension of the research problem. The qualitative analysis was instrumental in

describing the procedures undertaken at the property, while the quantitative method was employed to quantify data and production costs at the farm.

The qualitative research approach involves in-depth analysis of the studied phenomenon. It aims to uncover underlying characteristics that may not be evident in quantitative research. Conversely, the quantitative approach relies on statistical tools both in data collection and analysis[4].

Data for this study was obtained from a family-owned poultry farm located in the district of São Roque, within the municipality of Santa Helena, State of Paraná, Brazil. The primary research objective is to determine the required quantity of egg dozens needed for the producer to cover all costs and expenses incurred on the family farm.

Through field visits, relevant data concerning production costs and expenses were gathered directly from the property owner. The selling price of the product and the production and distribution methods were also analyzed.

Visits took place on June 15th, 2020, July 10th, 2020, August 14th, 2020, September 1st, 2020, and November 3rd, 2020, during which essential information was collected for this study's preparation and subsequent data analysis to achieve the research objectives.

Data analysis entails meticulous examination and processing of all information obtained during data collection, incorporating insights from interviews, questionnaires, reports, and other available sources[4].

Following data collection, the information was tabulated using Microsoft Excel spreadsheets to compute total production costs and determine the break-even point and contribution margin. These calculations were aimed at determining the necessary volume of egg sales to cover all production costs effectively.

IV. Analysis and Interpretation of Results

In this section, we present the analysis of the data collected at the property under study in this research. Firstly, we provide the location of the property in question. Subsequently, the data analysis is divided into individual and total production costs. Finally, we conclude with an analysis of the contribution margin and break-even point.

Location of the Studied Property

The data for this research were collected at a poultry farm located in the West region of Paraná, in the rural area of the São Roque district, in the municipality of Santa Helena – PR. The farm is of a family-owned nature, employing family labor in the production process.

The city of Santa Helena has a warm and temperate climate, with significant rainfall throughout the year. Even during the dry period, the rainfall is considered positive, with an average temperature of 20.7°C and an annual rainfall average of 1635 mm[10].

During the visits to the property, it was observed that the farm's poultry house structures are built in the East-West direction, made of masonry and with internal flooring. The structure is well-maintained, and automated feeders are used. The sides of the poultry houses are covered with tarps that can be moved when necessary, such as closing them at night and opening them during the day to allow for proper air circulation.

The production is carried out in batches, with the batch analyzed in this study consisting of 16,000 laying hens. The initial production processes, from the purchase of chicks to the production phase, were analyzed.

After determining all the expenses for the establishment of the fixed assets, which correspond to four and a half months or 18 weeks, the production costs for one year were analyzed to assess all costs and revenues during this period and, thus, determine the break-even point and contribution margin, i.e., the number of eggs needed to cover all production costs and reach the zero point.

In the first week of chicks' lives, they require heating as they do not have feathers, and thus, the internal temperature of the poultry houses is adjusted to 32°C to ensure the birds' body warmth. From 15 days of age, the temperature inside the houses is reduced as the birds have feathers that provide them with body warmth. Thus, the heaters are programmed to match the ambient temperature or are turned off.

After identifying the property's location and the method of raising the birds, the management of the birds was examined, which is presented in the next section.

Management Method

At the studied property, the owner has a programmed feeding system that varies according to the birds' needs. The consumption changes according to the bird's age, as it varies in each period.

Water is provided at will because, according to Cardozo et al. (2015), water consumption is a way for animals to control ambient temperature and is a more effective way of providing medication. In addition to providing water to the birds, it is also used for cleaning the area. It is worth noting that each poultry house has a pyramid-shaped cage structure, which facilitates cleaning.

The pyramid shape helps direct the waste, preventing it from falling onto the birds housed on the lower part of the cage. The cages were designed with three floors in a pyramid shape, with dimensions of 50 x 45 x 45 and capacity for five hens.

After presenting the bird management method, all production costs were examined, with a focus on one batch, initially separating the establishment of fixed assets and subsequently analyzing the costs of the birds in production.

Production Costs

In this section, the production costs of the farm's eggs will be presented, following the specific objective proposed in this study. Initially, the costs will be presented individually, concluding with the total production costs. The costs include electricity, water, feed, labor, chick acquisition, vaccination, packaging, maintenance of delivery vehicles, losses in the growth process of the laying hens, depreciation of the buildings, expenses for veterinarians, and depreciation of the laying hens.

The expenses are divided into two stages. The first details the costs related to the initial production phase, which forms the fixed assets of the birds on the property, and the second stage will present the egg production process. This process was analyzed for one batch of production over a period of one year, with a flock of 16,000 (sixteen thousand) laying hens.

Production Phase - Formation of Fixed Assets

The initial production phase is related to the process of forming laying hens, i.e., the establishment of the birds as fixed assets on the property. All items are detailed separately. This process takes approximately 18 weeks or 4.5 months.

a. Electricity

The expenditure on electricity in egg production is variable, and one of the factors that most influence its consumption is the climate. During the summer, the property's consumption increases by 100% compared to the winter season when electricity consumption reduces by nearly 50%. The studied property provides a natural ventilation system, as the poultry houses have openings on the sides. These sides are covered with easily manageable tarps, allowing them to be raised as needed, maintaining the environment at an ideal temperature of 25°C. Malavazzi's study (1982) emphasizes the importance of keeping the bird's housing environment at a temperature of around 25°C, highlighting the need for temperature control.

The opening of the poultry house's sides is done during the winter, making the environment cooler and reducing electricity consumption, as there is less need for the use of fans due to milder days. The monthly expenses for electricity on the property amount to approximately R$4,092.50 (four thousand ninety-two Brazilian reais and fifty centavos). Therefore, in the initial phase, which corresponds to 4.5 months, the total expenditure amounts to R$18,416.25 (eighteen thousand four hundred sixteen Brazilian reais and twenty-five centavos).

b. Water

Water supply on the property is provided through a borehole. Thus, there is no water bill. The only cost involved in water supply is the electricity used by the pump to extract water from the borehole. Besides being used for the birds' consumption, water is employed for cleaning and sanitizing the environment and for the exhaust fans during hot periods, to cool the environment to the ideal temperature. Water consumption increases with heat, confirming the analysis made in Malavazzi's study (1982). The animals themselves tend to consume more water during hot periods to regulate their body temperature. It is estimated that water consumption on the property on hot days reaches 30 cubic meters, according to information from the owner. However, the costs of water are zero, with only the cost of electricity used for the borehole pump, which is already accounted for in electricity costs.

c. Feed - Ration

The studied property, not having a partnership or integration with any cooperative, produces its own feed. The feed production follows criteria established by veterinarians and chick suppliers to meet the birds' physiological and nutritional needs. To achieve better productivity, some care is taken during the feed production process, including using raw materials and essential minerals for production. Feed production has been carried out on the property for over 15 years, and a detailed table of each ingredient composing the product is used, provided by the chick suppliers. The approximate cost of one ton of ready-to-consume feed for the birds is R$890.00 (eight hundred ninety Brazilian reais).

Table no 1 Presents the list of ingredients comprising the feed and the cost of each, showing the total cost per ton. The amount of feed consumed by each bird is determined by a table provided by the ingredient suppliers and analyzed by the veterinarians who assist in the property's production process.

Table no 1: Presents the list of ingredients comprising the feed.

Ingredients	Cost/kg	Qty/kg	Total value
Meat meal	R$1.30	32	R$41.60
Limestone	R$0.15	90	R$13.50
Salt	R$0.50	3	R$1.50
Premix vitamin	R$20.00	4	R$80.00
Soybean	R$1.50	220	R$330.00
Corn	R$0.65	651	R$423.15
Total		1,000	R$890.00

Source: Developed by the authors (2020).

Table no 2 Presents the feed consumption of the birds in the initial phase, per quantity in grams to be consumed, the bird's weight, and the amount of feed consumed per unit, with this batch consisting of approximately 16 thousand birds in the studied property.

Table no 2: Presents the feed consumption of the birds.

Week	Age	Daily Feed Consumption per Bird (kg)		Accumulated Feed Consumption per Bird		Body Weight (kg)	
		kg	kg	kg	kg	kg	kg
1	0 to 7	10	12	70	84	64	67
2	8 to 14	16	18	182	210	132	139
3	15 to 21	24	26	350	392	211	221
4	22 to 28	31	33	567	623	296	312
5	29 to 35	36	38	819	889	388	408
6	36 to 42	41	43	1,106	1,190	485	510
7	43 to 49	45	47	1,421	1,519	584	614
8	50 a 56	49	51	1,764	1,879	685	720
9	57 a 63	53	55	2,135	2,261	786	829
10	64 a 70	57	59	2,534	2,674	889	932
11	71 a 77	60	62	2,954	3,108	984	1,034
12	78 a 84	63	65	3,395	3,563	1,079	1,134
13	85 a 91	66	68	3,857	4,039	1,169	1,229
14	92 a 98	69	71	4,340	4,536	1,255	1,319
15	99 a 115	72	74	4,844	5,054	1,335	1,404
16	106 a 112	75	77	5,369	5,593	1,409	1,481
17	113 a 119	78	80	5,915	6,153	1,476	1,552
18	120 a 126	83	85	108	6,749	1,237	1,615

Source: Developed by the authors (2020).

The total feed consumption per bird during the initial phase, i.e., until the eighteenth week, corresponds to 6.497 kg. As the property has approximately 16 thousand birds in this phase, the total consumption reaches around 104 thousand kg of feed. As calculated, the cost per kg of feed amounts to R$0.89 (eighty-nine centavos of Brazilian reais), and the feed consumption in the eighteen weeks is approximately R$92,517.28 (ninety-two thousand five hundred seventeen Brazilian reais and twenty-eight centavos). Analyzing the monthly value, the expenditure is approximately R$20,505.60 (twenty thousand five hundred five Brazilian reais and sixty centavos), or R$1.28 (one Brazilian real and twenty-eight centavos) per unit, in feed consumption. Thus, the monthly feed consumption is approximately 1.44 kg (one kilogram and forty-four grams) per unit, as presented in Table no 3.

Table no 3: Feed Consumption and Cost - Initial Phase

Items	Consumed (g) Per unit	Birds 16,000	Tonnes 1,000	Total R$890.00
Cost per kg of tonne			1	R$0.89
Consumption 1 - 4 weeks	0,567	16,000	9,035	R$8,041.15
Consumption 4 - 8 weeks	1,197	16,000	19,500	R$17,355.00
Consumption 8 - 12 weeks	1,631	16,000	26,096	R$23,140.00
Consumption 12 - 16 weeks	1,974	16,000	31,584	R$27,946.00
Consumption 16 - 18 weeks	1,125	16,000	18,065	R$16,077.85
Total Expenditure in 18 weeks	**6,497**	**16,000**	**103,952**	**R$92,517.28**
Unit Expenditure in 18 weeks	6,497	1	0.89	R$5.78
Monthly Expenditure on feed	1,44	16,000	23.040	R$20,505.60
Unit Monthly Expenditure	1,44	1	0.89	R$1.28
Expenditure on 16,000 birds		**16,000**	**5,782**	**R$92,517.28**

Source: Developed by the authors (2020).

The feed cost may vary slightly due to losses during the process. However, for the calculation purposes of the total consumption during this period, the initial batch quantity was considered, 16 thousand birds, as shown in Table no 4, demonstrating the consumption and detailed costs, monthly and yearly, with feed.

Table no 4: Summary of Feed Consumption in the Initial Phase

Quantity of Birds	Feed Consumption per Month	Total Consumption in 4.5 months
1 bird	1.44 kg	6.497kg
16,000	23,040 kg	104,000 kg
Unit Cost	Months	4.5 Months
0.89 per kg	**R$20,505.60**	**R$92,517.28**

Source: Developed by the authors (2020).

After verifying and analyzing the cost of feed purchase, the values related to chick acquisition were examined.

d. Chick Procurement

The subject property performs the entire production process, from procurement to the rearing of chicks. The cost of purchasing each chick used in the property amounts to R$2.80 per unit. Additionally, there is an associated expense in this initial process, namely vaccination, with a cost of R$1.20 per chick.

Vaccination of the chicks occurs in stages. On the first day, vaccination is administered for diseases such as Marek's disease, Gumboro, and fowlpox. The subsequent stage takes place on the seventh day, with vaccinations against infectious bronchitis (H120) and Gumboro. To prevent losses and contamination among the already productive flock, ongoing monitoring takes place, and if necessary, vaccinations are administered during the laying hen phase, such as the vaccination against infectious bronchitis and Gumboro.

In a batch of 16,000 chicks, the vaccination expense totals R$19,200.00 (nineteen thousand two hundred Brazilian reais), and the overall cost of chicks and their vaccination amounts to R$44,800.00 (forty-four thousand eight hundred Brazilian reais). Consequently, the total expenditure on chicks and vaccination reaches R$64,000.00 (sixty-four thousand Brazilian reais).

One of the specific objectives of this study was to assess the life span of the birds. According to the owner's report, at the end of the first phase, a mortality rate of 2% of the total number of chicks occurs, approximately corresponding to 320 (three hundred twenty) birds. Therefore, by the end of the first phase, around 15,680 (fifteen thousand six hundred eighty) birds remain.

e. Labor

The labor force utilized on the property is primarily comprised of family members, with specialized services, such as veterinarians, being outsourced. These professionals contribute to decision-making processes, ensuring optimal production practices to minimize losses. As emphasized in Santos's research (2001), skilled labor enhances performance and productivity, reducing losses from the early stages of chick life up to their production and disposal. This aspect is evident in the studied property due to the involvement of veterinarians who aid in decision-making and monitor the production process.

The proprietor employs two veterinarians to assist in weighing and administering necessary medications. Expenses related to one of the veterinarians amount to R$500.00 (five hundred Brazilian reais) per month. The other veterinarian does not receive monetary payment but instead, compensation is provided through the exchange of products and services. The veterinary services include the analysis of medication required for preventive application to the birds. Veterinary services are available to the proprietor at any time.

Since labor is mainly provided by family members, tasks such as egg collection, feed distribution to laying hens, egg packing, and production are carried out by the owner's family. Their remuneration, in the form of pro-labore, amounts to R$4,500.00 (four thousand five hundred Brazilian reais).

f. Vehicle and Machinery Maintenance

The property owns vehicles used for product delivery and sourcing ingredients necessary for production. Expenses related to transportation, i.e., fuel costs for the farm, amount to approximately R$1,900.00 per month, due to the use of three vehicles.

As the property is in São Roque district, it is necessary to procure ingredients for feed production in Santa Helena municipality. Corn is sourced from the city headquarters, while soybean meal is obtained from Céu Azul municipality. It should be noted that these trips are conducted three times a month.

Among the fuel expenses related to ingredient procurement for feed production, the property also has another vehicle used for selling and delivering egg cartons. Given these transportation processes, monthly

expenses on vehicle maintenance amount to around R$500.00. As for technological innovations in the production process, Tubino (2000) remarks that the development and improvement of machinery help reduce labor time. The property employs a conveyor belt for the egg collection process, and bird feeding is automated. Consequently, monthly maintenance costs for machinery amount to approximately R$550.00.

g. Total Costs of the First Phase - Immobilization

By considering the initial expenses incurred during productivity, from acquisition until the eighteenth week when the birds' productivity commences, the total costs in this phase were determined.

Upon assessing all values, the value of the immobilized assets of these animals was calculated. This refers to the value of the production lot at the property, from which the egg production, the final product commercialized on the property, will begin. The values of energy, water, feed, chick acquisition, labor, and vehicle and machinery maintenance led to a total expense of R$210,788.53 (two hundred ten thousand seven hundred eighty-eight Brazilian reais and fifty-three centavos) in the initial phase.

Analyzing the expenses on a monthly basis, the amount reaches approximately R$96,548.10 (ninety-six thousand five hundred forty-eight Brazilian reais and ten centavos). Dividing this amount by the number of birds, that is, 15,680 birds, yields a monthly cost of approximately R$6.16 (six Brazilian reais and sixteen centavos) per bird. Table no 5 presents the expenses in the initial phase.

Table no 5: Total Expenditure in the Initial Phase - Immobilization

Description of Item	Monthly	Monthly/15,680	4.5 Months	4.5 Months/15,680
Electricity	RS 4,092.50	0.26	R$18,416.25	1.17
Water	R$0.00	0.00	R$0.00	0.00
Feed	R$20,505.60	1.31	R$92,517.28	5.90
Chick Procurement	R$44,800.00	2.86	R$44,880.00	2.86
Vaccination Costs	R$19,200.00	1.22	R$19,200.00	1.22
Labor and Veterinary	R$5,000.00	0.32	R$22,500.00	1.43
Vehicle – Fuel	R$1,900.00	0.12	R$8,550.00	0.55
Mechanical Expenses	R$500.00	0.03	R$2,250.00	0.14
Machinery Maintenance	R$550.00	0.04	R$2,475.00	0.16
Total	**R$96,548.10**	**6.16**	**R$210,788.3**	**13.44**

Source: Developed by the authors (2020).

After verifying the initial expenses and the formation of immobilized assets, the analysis of production costs was conducted, as outlined in the next section.

Egg Production Cost

This section demonstrates the costs after the initial phase of bird immobilization. Some costs were calculated monthly, with no differentiation between phases, such as energy, water, labor, vehicle, and machinery maintenance. Therefore, the costs that vary during this production phase, namely feed and packaging, were listed separately.

a. Feed

Following the same criteria as in the first phase, i.e., the growth phase of the chicks, the production phase also adheres to a table established by suppliers to determine the ideal weekly feed consumption per bird's age. This phase corresponds to the production of hens, i.e., these birds are already laying eggs for commercialization, with a batch of approximately 15,680 (fifteen thousand six hundred eighty) birds. The expenses incurred in feed consumption for a batch of 15,680 birds' amount to around R$2.78 (two Brazilian reais and seventy-eight centavos) per bird monthly, with a feed consumption of approximately 3.123 kg (three kilograms and one hundred twenty-three grams) per month, per bird. The annual feed cost is around R$523,026.94 (five hundred twenty-three thousand twenty-six Brazilian reais and ninety-four centavos), with a consumption of 587,670 kg (five hundred eighty-seven thousand six hundred seventy kilograms) of feed. After verifying the costs of feeding the birds, the costs associated with packaging used for egg storage were analyzed.

b. Packaging

The packaging costs are divided into two parts. The first refers to the individual dozen packaging, i.e., the box containing a dozen eggs, which is used for commercialization. The second part refers to the boxes used to store the individual dozen packages and are used for transportation to points of sale. The cost of the individual dozen packaging is R$0.24 (twenty-four Brazilian centavos). As for the transportation box, which has a capacity of 30 dozen eggs, the cost is R$2.55 (two Brazilian reais and fifty-five centavos). The total cost of the individual

packages in each transportation box, i.e., the 30-unit boxes transported in the larger box, amounts to R$7.20 (seven Brazilian reais and twenty centavos). Therefore, the total packaging cost up to the consumer is R$9.75 (nine Brazilian reais and seventy-five centavos), and the unit cost is calculated by dividing the total value by the 30 dozen, resulting in R$0.32 (thirty-two centavos).

c. Depreciation

The property has a shed for the allocation of birds, valued at R$96,000 (ninety-six thousand Brazilian reais). The annual depreciation calculation is 4%, corresponding to R$3,840 (three thousand eight hundred forty Brazilian reais). As for the depreciation of the birds, the calculation is based on the immobilization value derived from the expenses in the initial phase, amounting to 50% per year, with the residual value deducted – the amount received from selling the birds at the end of the process. The birds of each batch remain on the property until they complete 12 months of production. After this period, they are sold at a residual unit value of R$3.91 (three Brazilian reais and ninety-one centavos). The approximate number of laying hens at the end of the production process, i.e., after 12 months, is 15,680 (fifteen thousand six hundred eighty) birds. Therefore, the amount received by the owner from the commercialization is R$61,308.80 (sixty-one thousand three hundred eight Brazilian reais and eighty centavos), and this amount is deducted from the immobilized value to calculate depreciation.

Thus, from the immobilized value of R$210,788.53 (two hundred ten thousand seven hundred eighty-eight Brazilian reais and fifty-three centavos), the deduction of R$61,308.80 (sixty-one thousand three hundred eight Brazilian reais and eighty centavos) results in an immobilized value used for depreciation calculation of R$149,480.00 (one hundred forty-nine thousand four hundred eighty Brazilian reais). Of this value, 50% corresponds to depreciation, amounting to R$74,740.00 (seventy-four thousand seven hundred forty Brazilian reais).

d. Total Costs

From the cost survey in the poultry production phase, specifically from the eighteenth week of the birds, the total production costs were determined, as well as the unit costs per bird. Based on the cost survey of a batch of 15,680 (fifteen thousand six hundred eighty) birds, an annual cost of approximately R$48.00 (forty-eight Brazilian reais) per unit was calculated, for twelve months of production.

Analyzing the total annual costs divided by the quantity of birds, the unit costs for electricity in one year amount to R$3.13 (three Brazilian reais and thirteen centavos) per bird. The feed consumption per unit represents a value of R$33.36 (thirty-three Brazilian reais and thirty-six centavos). Labor costs amount to approximately R$3.83 (three Brazilian reais and eighty-three centavos) per bird. The costs for fuel consumption and vehicle maintenance are R$1.45 (one Brazilian real and forty-five centavos) per bird. Mechanical costs are about R$0.38 (thirty-eight centavos) per bird. Machine maintenance corresponds to R$0.42 (forty-two centavos) per bird. Bird depreciation amounts to R$4.77 (four Brazilian reais and seventy-seven centavos) per unit, and property depreciation is R$0.24 (twenty-four Brazilian centavos) per bird.

Analyzing the total production costs, it was found that monthly, when divided by the quantity of birds in the analyzed batch, i.e., the 15,680 (fifteen thousand six hundred eighty) birds, the cost amounts to R$3.97 (three Brazilian reais and ninety-seven centavos) per bird.

To complete the total cost, the expenses related to packaging need to be considered. For calculating the packaging cost, the value corresponding to a box with 30 dozen eggs, used for commercialization of the product, was utilized and multiplied by the quantity of dozens of eggs produced on the property. The property produces 41 (forty-one) boxes daily, 1,217 (one thousand two hundred seventeen) boxes monthly, and 14,598 (fourteen thousand five hundred ninety-eight) boxes of thirty dozen eggs annually.

Considering that each box with 30 (thirty) dozen eggs costs R$9.75 (nine Brazilian reais and seventy-five centavos), the daily cost amounts to R$399.75 (three hundred ninety-nine Brazilian reais and seventy-five centavos), the monthly cost is R$11,865.75 (eleven thousand eight hundred sixty-five Brazilian reais and seventy-five centavos), and the annual cost is R$142,330.50 (one hundred forty-two thousand three hundred thirty Brazilian reais and fifty centavos).

Total Production Costs x Quantity Produced

After assessing the total production costs on a monthly and annual basis, the quantity of egg production was determined. The production begins from the eighteenth week, and each hen produces one egg per day, totaling 30 eggs per month and 365 eggs annually. The production batch is renewed at the end of a year, starting a new cycle with a new batch.

According to information gathered from the farm owner, the egg production per hen is 95%, meaning some lay eggs every day while others do not. If all hens laid one egg per day, the production would be 15,680 (fifteen thousand six hundred and eighty) eggs per day. With a reduction percentage of 5% (five percent), the daily quantity corresponds to 14,896 (fourteen thousand eight hundred ninety-six) eggs.

As per the owner, there is a percentage of breakage during handling or due to the hens themselves, which represents approximately 2% (two percent) of the daily quantity. Hence, the daily quantity, excluding the 2% (two percent) breakage, amounts to 14,598 (fourteen thousand five hundred ninety-eight) eggs. This corresponds to a daily production of 1,217 (one thousand two hundred seventeen) dozen of eggs, totaling 41 boxes of thirty dozen eggs.

Analyzing the monthly production quantity, the volume is approximately 437,940 (four hundred thirty-seven thousand nine hundred forty) units of eggs, not considering losses and breakages. The quantity in dozens is about 36,495 (thirty-six thousand four hundred ninety-five) for resale, and considering in boxes of thirty dozen eggs, the volume is 1,217 (one thousand two hundred seventeen) boxes of eggs per month.

The annual egg production is 5,255,308 (five million two hundred fifty-five thousand three hundred eight) units, not considering losses and breakages. This quantity corresponds to 437,942 (four hundred thirty-seven thousand nine hundred forty-two) dozen and a total of 14,598 (fourteen thousand five hundred and ninety-eight) boxes with thirty dozen eggs.

Table no 6 shows the calculations of the quantity produced per day, monthly, and annually, considering 100% production, disregarding the 5% partial production, and deducting the 2% breakages.

Table no 6: Quantity of Production

Analysis of calculations	Egg production		
	Daily	**Monthly**	**Annual**
Days	1	30	360
100% Production	15,680	470,400	5,644,800
Monthly Production Loss 5%	784	23.52	282,240
Total Production	14,896	446,880	5,362.560
Egg Handling Breakage 2%	298	8,937	107,251
Net Egg Production	14,598	437,942	5,255,308
Dozens Production	1,217	36,495	437,942
Box with 30 dozen	**41**	**1,217**	**14,598**

Source: Developed by the authors (2020).

The unit costs were analyzed alongside the quantity produced, enabling the verification of the unit costs. It was found that the cost from the initial process to the final production phase is R$0.17 (seventeen Brazilian centavos). After assessing the unit costs, it was verified that the revenue from the egg sales per unit would amount to R$0.19 (nineteen Brazilian centavos). With the calculation of production costs and revenue from sales, the producer gains R$0.03 (three Brazilian centavos) per unit of egg, meaning the owner will have a profit of R$0.36 (thirty-six Brazilian centavos) for the sale of one dozen eggs.

Table no 7 presents the unit calculation of costs and revenues for each produced and sold egg.

Table no 7: Unit Cost and Revenue of Eggs

Analysis of calculations	Egg Production		
	Daily	**Monthly**	**Annual**
Days	1	30	360
Net Egg Production	14,598	437,942	5,255,308
Unit Cost of Eggs	R$0.17	R$0.17	R$0.17
Box with 30 dozen	41	1,217	14,598
Cost of Production	**R$2,467.90**	**R$74,037.23**	**R$888,447.44**
Net Egg Production	14,598	437,942	5,255,308
Unit Selling Price	R$0.19	R$0.19	R$0.19
Box with 30 dozen	41	1,217	14,598
Revenue	**R$2,870.00**	**R$85,190.00**	**R$1,021,860.01**

Source: Developed by the authors (2020).

With the analysis of the quantity produced, the next step was to verify the revenue derived from the commercialization of the production.

Revenue for the Period

After calculations and verification of monthly and annual production costs, the revenue for the period was analyzed. As observed during one of the visits to the property, the sale of a box with 30 dozen eggs corresponds to a value of R$70.00 (seventy Brazilian reais). With the determination of the unit price, it was observed that each egg to be sold is priced at R$0.19 (nineteen Brazilian centavos). With a flock of 15,680 birds

and a daily production of 14,600 eggs, the daily revenue amounts to R$2,870.00 (two thousand eight hundred seventy Brazilian reais). The monthly revenue is approximately R$85,190.00 (eighty-five thousand one hundred ninety Brazilian reais) and the annual revenue amounts to R$1,021,860.00 (one million twenty-one thousand eight hundred sixty Brazilian reais).

With the cost assessment and production figures, the specific objective proposed in this study was achieved. After detailing the egg production process, listing the incurred costs during the process, and estimating the animals' useful life, the break-even point and the contribution margin were determined, which is detailed in the next section.

Break-even Analysis and Contribution Margin

The break-even point represents the number of egg cartons needed to cover all costs and expenses for a zero-profit scenario. The break-even point does not indicate the profitability of the business but rather the exact quantity required to cover all expenses, demonstrating that above this quantity, the company will make a profit. Therefore, the number of egg cartons that the family-owned property needs to sell to cover all variable and fixed costs of the production process was calculated.

On the other hand, the contribution margin corresponds to the selling price minus the variable costs, and the result shows how much each unit sold contributes to covering the fixed costs. To calculate the contribution margin and break-even point, the first step was to separate the costs and expenses into fixed and variable.

For classification, all costs that, according to the owner, do not change during the production cycle were considered fixed costs. Therefore, the fixed costs for this study are electricity, water, family labor, veterinarian labor, fuel, vehicle maintenance, machine maintenance, and property depreciation, totaling an amount of R$148,350.00 (one hundred forty-eight thousand three hundred fifty Brazilian reais).

For the classification of variable costs, an analysis was made of what truly impacts the quantity of birds in the flock. Among the variable costs are feed, depreciation of the birds, and packaging, totaling an amount of R$740,097.44 (seven hundred forty thousand ninety-seven Brazilian reais and forty-four centavos).

Table no 8 shows the classification of fixed and variable costs.

Table no 8: Classification of Fixed and Variable Costs

Items	Fixed Costs	Variable Costs
Electricity	R$49,110.00	
Water	R$0.00	
Feed		R$523,026.94
Labor	R$60,000.00	
Vehicle – Fuel	R$22,800.00	
Mechanics	R$6,000.00	
Machine Maintenance	R$6,600.00	
Depreciation – BIRDS		R$74,740.00
Property Depreciation 4%	R$3,840.00	
Packaging		R$142,330.50
Total	**R$148,350.00**	**R$740,097.44**

Source: Developed by the authors (2020).

The total variable costs of R$740,097.44 (seven hundred forty thousand ninety-seven Brazilian reais and forty-four centavos) divided by the quantity of 14,598 (fourteen thousand five hundred ninety-eight) boxes of 30 (thirty) dozen eggs produced annually amount to R$50.70 (fifty Brazilian reais and seventy centavos) per box containing 30 (thirty) dozen eggs.

With the classification of costs into fixed and variable, the next step is to calculate the contribution margin to finalize with the break-even point, which uses the contribution margin in its formula.

As reported by the owner, the products, the dozen eggs, are sold in boxes containing 30 (thirty) each. For the calculation of the contribution margin, the box's revenue value was used, and the costs were also divided by the quantities of boxes produced. According to the owner, the selling price of a box with 30 (thirty) dozen eggs is R$70.00 (seventy Brazilian reais); therefore, the contribution margin would be R$70.00 of the selling price - R$50.70 of the variable costs, totaling a contribution margin of R$19.30 (nineteen Brazilian reais and thirty centavos). Thus, each box with 30 (thirty) dozen eggs sold contributes R$19.30 (nineteen Brazilian reais and thirty centavos) to pay for the fixed costs. With the value of the contribution margin, the break-even point was calculated, using the fixed costs divided by the contribution margin.

The fixed expenses and costs amount to R$148,350.00 (one hundred forty-eight thousand three hundred fifty Brazilian reais). Therefore, the Break-even point is 7,687 (seven thousand six hundred eighty-seven) boxes with 30 dozen eggs. Above this quantity, the company will make a profit. It can be observed that the producer

needs to sell 7,687 (seven thousand six hundred eighty-seven) boxes with 30 (thirty) dozen eggs to cover all the costs of the production batch. As the property produces annually 14,598 (fourteen thousand five hundred ninety-eight) boxes with 30 dozen eggs, and monthly 1,217 (one thousand two hundred seventeen) boxes, it would take approximately 6.5 months to pay for all production costs, and the remaining 5.5 months would be the property's profit.

With the obtained result, the general objective proposed in this work was achieved: to determine the number of dozen eggs required for the producer to cover the costs and expenses of a family farm. It is concluded that 7,687 (seven thousand six hundred eighty-seven) boxes with 30 (thirty) dozen eggs, corresponding to 230,610 (two hundred thirty thousand six hundred ten) dozen eggs, are needed to cover all production costs.

V. Final Remarks

The study's primary objective was to determine the required number of dozen eggs for the producer to cover the costs and expenses of a family farm, essentially finding the break-even point. This investigation took place in a laying hen farm situated in the district of São Roque, within the interior of Santa Helena municipality, in the western region of the state of Paraná. To achieve our goal, we employed managerial accounting, agricultural accounting, and cost accounting. These methodologies allowed us to uncover both direct and indirect production costs related to a one-year production batch, comprising 15,680 birds.

Consequently, we successfully addressed our research question, revealing that the property needs to sell 230,610 (two hundred thirty thousand six hundred ten) dozen eggs to cover all expenses and production costs of a batch of birds. Beyond this quantity lies the surplus, representing pure profit. As a matter of fact, with an annual production of 437,942 (four hundred thirty-seven thousand nine hundred fourty-two) dozen eggs, the sale of the 207,332 (two hundred seven thousand three hundred thirty two) dozen eggs results in a lucrative outcome for the owner.

A key contributing factor to the property's strong profitability is the utilization of family labor throughout the entire production process, from farming to the delivery of the dozen eggs to the market. If the farm were to rely on third-party labor, the production costs would be considerably higher. The findings from this study provide crucial insights for the property owner to make informed decisions in the production process, enabling comprehensive analysis of costs and financial returns within a production batch. This underscores the significance of accounting in facilitating the production process and furnishing invaluable information for effective decision-making.

As a suggestion for future research, it would be advisable to conduct a comparative study between the analyzed property and another farm engaged in egg production. Such a comparison would enable a deeper understanding of the cost structures and financial performance of different farming enterprises.

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