Economic viability of a small frog slaughtering industry

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Summary

Brazil, having ideal climatic conditions for breeding frogs in captivity, has seen an increase in activity in recent years. Frog farming in the country still has a lot to develop, but it is already a highly profitable activity, when carried out by qualified and trained people. With the growing search for healthy foods, interest in frog meat is growing as it is an important source of protein. The frog has high versatility in culinary use, and can be used to prepare various dishes or even in simple portions, pleasing the most sophisticated palates. Regarding commercialization, frog meat has high acceptability as it is a quality product with high nutritional power, in addition to having a market for all its waste. The lack of a slaughterhouse of its kind in the region was one of the reasons that motivated the study. With its implementation, it would be possible to strengthen the production chain in the region. A great advantage of the activity is the full use of raw materials. The project made it possible to visualize the quick return that the activity provides when carried out in compliance with the sector's quality and regulatory standards and the high profitability, considering the relatively low investment.

Key words: Agroindustry, profitability, Processing,rana catesbeiana .

Abstract

Brazil has an ideal climate for frog breeding in captivity and has seen growing activity in recent years. The frog culture in the country still has a lot to develop, but it is a highly profitable activity when performed by qualified personnel and trained to do so. With the growth of the search for healthy foods there has been growing interest in the frog meat due to being important protein source. The frog has high versatility in culinary use and can be used in the preparation of various dishes or even simple parts, pleasing the most sophisticated palates. As for marketing the frog meat has high acceptability for being a quality product and high nutritional value, in addition to market for all its waste.

The lack of an abattoir of its kind in the region was one of the reasons that motivated the study. With its implementation it would be possible to strengthen the supply chain in the region. One of the great advantages of the activity is the total utilization of raw material, its refuse and waste, with a large gap activity. The project enabled to see quick return to activity when done watching provides quality standards and industry regulations and high profitability, given the relatively low investment.

Keywords: Agribusiness, profitability, processing, incomecatesbeian

INTRODUCTION

In the search for a healthier diet, from the 1980s onwards, consumption

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of meat considered white has increased considerably. This trend has provided a considerable increase in aquaculture. In 2008, world production reached 73 million tons (LOPEIRA-BARREIRO *et al.*, 2010).

In the period between 2003 and 2009, Brazilian aquaculture production grew by 25%, above the global figure, which was 10% in the same period (OSTRENKY et al., 2008). This scenario enabled great growth in frog farming in Brazil, highlighted by the quality of the meat and excellent source of protein.

According to FAO (2010), global production of frog meat, during the period 1999-2008, was around 44,000 tons per year, reaching 85,000 tons in 2008.

Brazil produces around 600 tons of frogs annually. The states with the highest production are: São Paulo, Minas Gerais and Pará (KOHLER, 2010).

Practically all Brazilian production is absorbed by the domestic market, but Brazil is capable of gaining a large share in the foreign market, however, it needs to prepare for this. As for by-products, we can say that the raniculturist practically makes money solely by selling the meat. The viscera and skin are almost entirely discarded. There is technology for tanning leather, but there is no industry that does this on a commercial scale (LIMA; CRUZ, 1999).

The implementation of an industry for slaughtering and processing any animal requires relatively high investments, and a team qualified to follow the same hygienic-sanitary standards that are adopted internationally, based on the food code of the *Food and Agriculture Organization*(FAO) (CODEX ALIMENTARIUS, 1984). For Negrini (2001), the potential demand for frog meat is three times greater than the supply, thus becoming an attraction for the installation of new companies.

2. BIBLIOGRAPHIC REVIEW

Frog farming in Brazil began in the 1930s, when Tom Cyrril Harrison brought the first 300 specimens of frogs from Canada.*Rana catesbeiana*, popularly known as the American bullfrog. In 1935, the first commercial ranário was established in Brazil, the Ranário Aurora, located in the municipality of Itaguaí, State of Rio de Janeiro, close to the Presidente Dutra highway. From 1975 onwards, other projects were built, but generally operating empirically (FERREIRA, 2002).

According to Vizzoto (1975), frog farming was introduced in Brazil in 1935, imported

in North America the first pairs of the bullfrog species. Due to its great adaptability, the bullfrog became the cultivated species in Brazil, with several cultivation systems emerging.

It is considered an exotic animal, as it originates from the USA (northeast) and Canada (southeast), where it lives in very low temperatures for several months of the year. When it was introduced in Brazil, it adapted perfectly to the country's climatic conditions, which favored its performance in relation to reproduction and fattening, quickly reaching sexual maturity and slaughter weight (seven months and one year on average, respectively) (LIMA & AGOSTINHO, 1988).

The consumption of frog meat is a habit as healthy as it is ancient, already mentioned by Herodotus (Greek philosopher, in the years 484-425 BC) in his writings, as a fine delicacy that the Greeks served to nobles in celebrations of the most distinguished and elevated society (LIMA*et al*, 2004).

The habit of consuming frogs in Brazil was a practice among low-income families. The animals were captured in the wild to supplement their diet. Later, some restaurants began to offer the product as an appetizer, which encouraged hunting for commercial purposes. As hunting provided an irregular supply of meat, it was necessary to wait for the development of commercial farming so that the supply became more systematic and some restaurants offered exquisite dishes based on meat (LIMA; AGOSTINHO, 1988).

Channeling the production of frog meat for commercialization will open up a large niche, as it can be known and popular, since, when introduced into the market, it will be easily found, arousing curiosity in consumers to try it or even consume it. with a certain regularity (CARRARO, 2008).

The price of products from Raniculture, on the international market, is quite variable depending on several factors, among which the size of the product, the time of year and its origin deserve to be highlighted. Those originating from captive breeding generally have a higher price, due to their own production costs and also because they have greater quality and regularity in supply (BELTRÃO, 2008).

The development of the bullfrog in Brazil is superior to that of its country of origin (USA). This statement is based on its performance for Brazilian conditions, which, on average, does not exceed four months in duration for the tadpole and fattening phases (FERREIRA; FONTANELLO, 2011).

Frog meat*in nature*(frozen or fresh) has always been the main product of

raniculture. The other products are still in the development and market consolidation phase, such as, for example, its skin, used in the treatment of burned people and in the manufacture of artifacts by the leather industry; the oil, in diverse applications such as cosmetics and medicines with a healing effect, the liver and ovary in culinary applications (liver pate and caviar, respectively) (LIMA, 2012).

Practically all Brazilian production is used by the domestic market, but Brazil is able to conquer a large space in the foreign market. Currently consumption in Brazil is around 400 tons/year. According to the Brazilian Frog Farming Association, Brazil has approximately 600 established frog farms, fifteen slaughtering and processing industries, six state frog farmers associations and four cooperatives (BELTRÃO, 2008). There are two distinct types of market for the raniculturist. The live animal market to serve other frog farmers (breeders, tadpoles and imagos), laboratories and university teaching and research centers. Another market, much larger than the first, that of slaughtered animals, has meat as its largest and most important product. Due to its characteristics (classified as exotic), and mainly its price, frog meat has a large market space among the privileged strata and higher sociocultural level (SEBRAE, 2009).

In Brazil, frog meat is found in commercial establishments in the form of carcasses or thighs. However, in the international market there is a strong preference for thighs, with demand for any other product practically non-existent (LIMA et al., 1999).

Internationally, the largest consumers and importers of frog meat are: the United States, France, Germany, Switzerland, Italy and the Netherlands. Countries such as Japan, China, Indonesia, India, Mexico and Cuba were once considered major exporters, but they did so thanks to their production as a result of extractivism, a fact that has been generating economic and ecological problems. Predatory hunting action puts the species at risk and imbalances the ecosystem. On the other hand, the use of pesticides and fertilizers on plantations, cradles for raising frogs in the wild, intoxicates the animals, making their commercialization difficult, due to sanitary barriers. This opens up a large space for Brazilian frog farming, which has been developing technology aimed at intensive production, within stricter controls (SEBRAE, 2009).

Potential customers for the sale of frozen frog carcasses are quite diverse, including: restaurants, bars, meat shops, fishmongers, supermarkets, *delicatessen* and party houses, in addition to direct sales to consumers in the company's own stores, whether at the establishment itself or in large cities.

3. METHODOLOGY

The study was prepared according to the steps defined by the Ministry of Agrarian Development, observing the guidelines proposed in the Roadmap for the Preparation of Agro-industrial Projects for Rural Territories (2007).

To carry out the project, research was carried out in national and international literature on the slaughter of frogs and fish. The standards and rules for installing a Fish Slaughterhouse were consulted. In the Manual of Procedures for the Implementation of Industrial Fish Establishments by MAPA - Ministry of Agriculture, Livestock and Supply (2007), it establishes rules for the correct installation of a slaughterhouse, following sanitary standards so that a quality final product can be obtained, harmless and with nutritional value for the final consumer.

When forecasting the cost, research was carried out to evaluate the production cost and the price paid per kilo of meat (legs, carcass and minced meat), waste and skin. The slaughter of 700 animals/day, of the species*Rana Catesbiana*(Bullfrog), weighing approximately 350 grams.

3.1 Technical Aspects

According to the Brazilian Association of Food Industries - ABIA (2003), the location of any food factory (agroindustry) must be defined considering some aspects of the location's infrastructure, such as the availability of water, sewage network, energy, transport routes and communication systems to guarantee future expansions in the production line. An analysis of the region's water quality is recommended to check whether it is within the desirable specifications for processing. Proximity to consumer centers and suppliers can mean a big step towards conquering the market and represents savings in transporting products (CORRÊA, 1999).

The location where the agroindustry is located has ideal urban infrastructure conditions, especially with regard to electrical and hydraulic installations, sewage network, treatment stations, easy communications (telephone, internet) and abundant water, explored through artesian wells. To choose the type of treatment used for slaughterhouse wastewater, we consider: the degree of removal required of pollutants,

area availability and system implementation, operation and maintenance costs (KATO, 1982).

The agro-industry land was free of contaminants of any kind and had an appropriate place to deposit waste; the agroindustry will be willing to guarantee aspects related to safety, movement and supervision of personnel, wind direction, sun position and terrain slope. The frog and fish slaughter agroindustry was implemented on the Fatec Rio Preto experimental farm, formerly IPA, in the municipality of São José do Rio Preto-SP. 700 frogs were slaughtered/day and during idle hours, fish were caught, depending on time and labor availability. The choice of the Northwest region of São Paulo was due to the lack of this category of agroindustry, aiming to increase frog farming activity, considering that the region is a large producer of fish due to the large rivers in the region. The location chosen for the implementation of the agroindustry meets all the basic requirements for the implementation of a slaughter agroindustry established by MAPA.

For physical installations, the industry was installed on a plot of land measuring 50m x 40m, totaling 2000 m² in area. The agribusiness building will have the following dimensions: Slaughter Building: 19m x 7.5m, totaling 142.5 m of masonry construction, figure 1. The administrative block will have a total of 68.4m², it was built separately from the slaughter block.

According to the Roadmap for developing agro-industrial projects proposed by the Ministry of Agrarian Development (2007), agro-industrializing means benefiting agricultural products and/or transforming agricultural raw materials, generating new products of animal and vegetable origin. The proposed agribusiness – Frog and Fish Slaughterhouse was built on a total area of 2,000m². Its classification, according to MAPA, is that of an Industrial Fish Establishment. Figure 1 presents the *layout* of the company, created observing the MAPA indications in the Manual of Procedures for the Implementation of Industrial Fish Establishments.

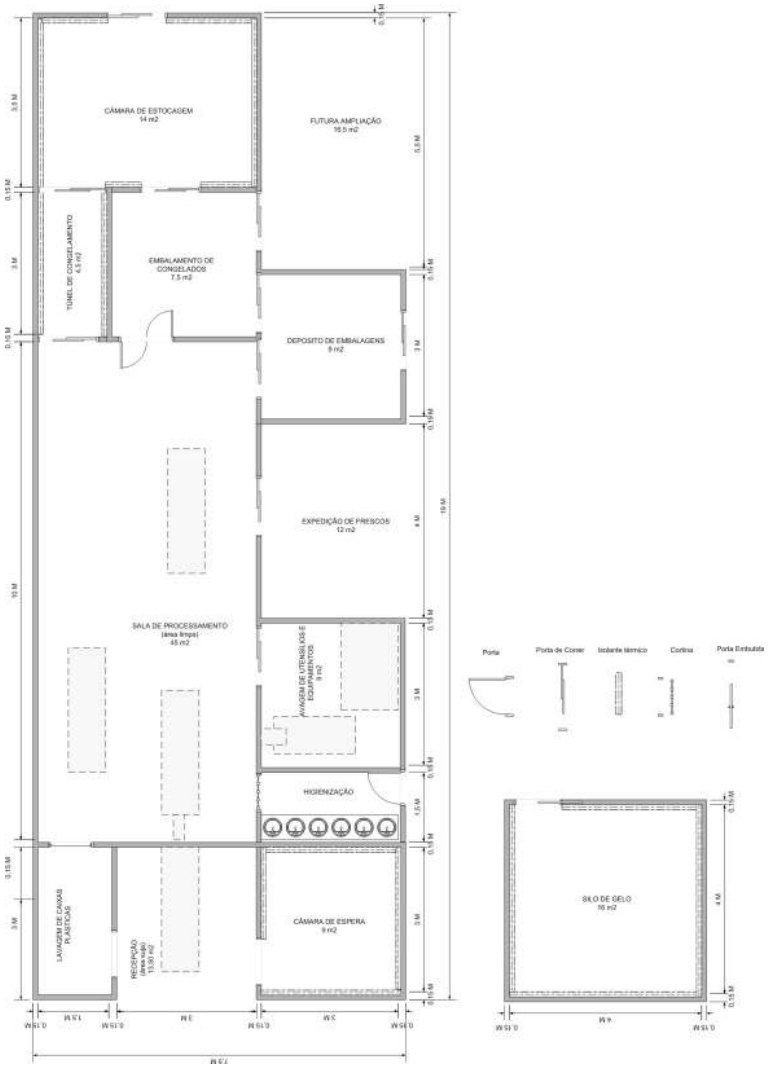

Figure 01: Plan of the slaughter area and ice silo.
Source: Prepared by the authors adapted from MAPA - Slaughterhouse Procedures Manual - 2007

According to Sandroni (1985), "raw material is a natural or semi-manufactured product (intermediate good) that must be subjected to a production process until it becomes a finished product". The suppliers were the region's ranchers and there is a parallel project for consortium production with producers in the region.

In the last decade, fish farming has been developing a lot in the Northwest region of São Paulo, mainly with super intensive farming and the use of net cages. The temperature, climate, flooded area of the reservoirs and public policies have favored this region so much that, currently, it has become the largest producer of fish originating from continental fish farming in the State (CASTELLANI, 2007). The roads in the Northwest of São Paulo for receiving raw materials and transporting production to São Paulo and other capitals are of excellent quality.

Article 438 of the Regulation on the Industrial and Sanitary Inspection of Products of Animal Origin (RIISPOA) defines, with the generic name "fish", crustaceans, fish, molluscs, amphibians, chelonians and freshwater or saltwater mammals used in human food; including frogs (BRASIL, 1997).

The facilities and operations flow were planned with strict linear flow criteria to avoid cross-contamination. Care was taken to ensure that the processing flow plant was continuous, without the initial phase of the process intersecting with later phases, avoiding possible contamination (RODRIGUES*et al*, 2010).

According to BRASIL (2006), the facilities presented, in accordance with sanitary standards, characteristics that enabled cleaning and hygiene, such as:

- Built in waterproof material on the inside;
- Linings and walls with a smooth, easy-to-clean finish;
- Waterproof, non-slip floors with a small slope that facilitated wastewater drainage, facilitating cleaning;
- Internal work environment must be closed with a seal against insects, rodents and other animals, with good ventilation and light;
- Clean area of the family agribusiness must be separated from the dirty area and the bathroom;
- Adequate height of the right foot, allowing ventilation, light and the placement of equipment;
- The corners between floors and walls were rounded, avoiding the accumulation of dirt and facilitating cleaning;
- A system for draining sewage, water and waste in general, connected to an adequate treatment or reuse system, in accordance with environmental standards.

According to the Manual of Procedures for Implementation of Industrial Fish Establishments (BRASIL, 2007), due to the importance of the refrigeration unit in the success of the enterprise, some care was taken in the acquisition:

- The real needs in terms of quantities and types of products to be produced;
- Reputable suppliers were consulted to check customer satisfaction listed in their reference lists;
- Detailed quotes were requested with a complete description of the equipment, indicating dimensions, capacities, materials used, and budgets accompanied by

leaflets, diagrams and schemes and other technical data necessary for the analysis and evaluation of what is offered;

• Suppliers listed all the additional equipment necessary for the operation of the refrigeration installation and which were not its responsibility to supply;

• Other needs were indicated: water, sewage and electricity points and their dimensions;

• Suppliers were required to have effective means to ensure operation, mainly from storage chambers, in case of equipment breakdown. The possibility of interconnection and exchange between equipment, mainly refrigeration compressors, if necessary, was also verified.

Aquaculture is yet another activity competing with others for water resources. Its development presents risks of deteriorating the quality and quantity of water, which may affect environmental, social and economic quality. Technical, scientific and representative currents of Brazilian aquaculture have stated that the activity does not consume, but rather, uses water, and this characteristic of non-consultancy could change approaches and strategies related to the management of water resources aimed at aquatic creations, distancing them, for example, industries (TIAGO & GIANESELLA, 2003). The effluent must comply with the release standards established in this resolution, according to the quality of the class in which the receiving water body is classified – CNRH: Conselho Nacional de Recursos Hídricos, Resolution nº 91/2008 (TIAGO, 2010).

One of the ways to guarantee quality and safety in agro-industries is the implementation of the Good Manufacturing Practices (GMP) program, which aims to provide the population with safe food. GMP are procedures that must be adopted by agribusinesses with the aim of guaranteeing the hygienic-sanitary quality of food in accordance with current legislation. This program covers five main points: water control, facility hygiene, personal hygiene, pest control and hygiene of equipment and utensils. With the need to ensure safe and quality food for the population, the Ministry of Health (MS) instituted Ordinance No. 326, of July 30, 1997 (BRASIL, 1997), together with Ordinance No. 368, of September 4, 1997. 1997 (BRASIL, 1997b) of the Ministry of Agriculture, Livestock and Supply (MAPA) the Technical Regulation on the "Hygienic-Sanitary Conditions and Good Manufacturing Practices (GMPs) for Food Producers/ Industrializing Establishments".

People who work with food handling must take care of personal hygiene, behavior and appearance. These precautions include: daily bathing; wearing clean clothes; hair should be washed at least twice a week; always brush your teeth after meals; keep your nails short and clean (always without nail polish); tied hair; do not use accessories when handling food (earrings, bracelets, rings, watches); do not eat, chew gum, smoke, cough, sneeze and avoid talking while handling food; wash your hands with soap and water frequently. Another important factor is the health of workers, which is why it was essential that laboratory tests were carried out periodically and whenever the handler presents health problems, it is necessary to be removed from work (BRASIL, 1997b).

Periodic water analysis is recommended, in accordance with sanitary requirements, keeping analysis records on file. Processed products must be sent for routine and regulatory analysis to accredited laboratories. From each batch, a sample must be stored for laboratory tests in case of health problems detected by health surveillance or by the consumer. The use of water in the food agroindustry was intense, involving everything from cleaning and sanitizing equipment, utensils and the environment to the final process stage. According to the*CODEX ALIMENTARIUS*(2003) it is of fundamental importance to fully control the water in a way that guarantees the physical, chemical and microbiological characteristics, so that there is no contamination of equipment and food.

Preparation of chlorinated water: according to Chitarra (1998), the sanitizing agent most used in industry is chlorine in the liquid form of sodium hypochlorite (NaOCl). Of the chlorine added to water, around 20% can combine with organic residues and only 80% remain in the active form, reducing the biocidal action when the chlorine concentration is low. Therefore, the chlorine solutions were prepared in accordance with the recommendations, remembering that excess chlorine can cause discoloration of the product, corrosion of equipment and intoxication of consumers.

Frog meat is mainly sold as: chilled or frozen whole frogs and frozen legs. According to MAPA's Technical Regulation for Labeling of Packaged Animal Products, labeling of packaged foods must necessarily present: product sales name, list of ingredients, net contents, identification of origin, name or company name and address of the importer (if applicable), official inspection stamp, establishment category, CNPJ, product conservation, product trademark, batch identification, expiration date and preparation instructions

and use of food (BRASIL, 2005).

Frog meat is seen as a healthy food, an excellent source of nutrients, rich in proteins, minerals and low in fat and calories. Its calcium bioavailability is high, reaching the same level as that of milk and dairy products. It can be indicated as a dietary supplement in the treatment of osteoporosis and high blood pressure. The freeze-drying of this meat provides an excellent raw material to be used in various products and for specific diet purposes (FRAGOSO*et al.,*2012).

Lima and Agostinho (1998 apud CARRARO, KC, 2008) state that frog meat, due to its composition, is recommended by doctors and nutritionists, as its fat content is 3%, being the only meat produced in captivity that has the 10 basic amino acids for humans and with high digestibility, as it is made up of short chain molecules, being especially recommended for feeding children who reject animal protein.

To add value to the segment, several alternatives are being studied to make better use of the meat from this part of the frog's body, including its use in baby food formulations, due to its high biological value (CONCEAÇÃO, 2000; MOURA, 1999; NÓBREGA*et al*., 2007).

Regarding the economically viable development of new by-products of frog farming, we can highlight the use of frog oil, liver and skin (FEIX*et al*., 2006). The properties of frog oil are being analyzed, and there are favorable results for its use in the production of cosmetics, while the liver is used for the production of pâtés. Frog skin can be used in the pharmaceutical or clothing industry. Velly (2001) highlighted the economic significance of using frog skin in the pharmaceutical industry, emphasizing the breeder's lack of knowledge regarding its commercialization possibilities. Keratin taken from bullfrog skin, for example, can be used as regenerative protective tissue for burned people.

One of the ideas for increasing the sale of frog meat is an approach to those responsible for school meals in an attempt to introduce it into students' diets as a source of protein. Another way to increase consumption is to make sufficient quantities available in commercial establishments, such as butchers, markets and*delicatessen*.

The survey on marketing channels carried out by Lima*&*Cruz (1999) showed that 16.3% of actual frog meat consumers do so due to health problems (OLIVEIRA*et al*., 2007). The main product of the activity is frog meat, which is sold fresh, frozen or processed, whose excellent flavor and nutritional qualities,

have led to considerable growth in consumption, despite price restrictions. The thigh is the most accepted part, although in Brazil this preference is not as pronounced as in the international market, where the rest of the carcass is practically not consumed (LIMA; CRUZ 1999). The slaughterhouse's production will be sold between supermarket chains, hotel chains and restaurants, through pre-signed contracts. The waste will be sold to animal feed factories and the skin to tanneries.

Another measure was to propose a national action to frog slaughterhouses to encourage the consumption of frog meat, based on the nutritional importance of this meat and to encourage small and medium-sized rural producers to produce frogs as a source of additional income.

3.2 Economic analysis

For the study, the slaughter of 700 animals/day was considered with 26 days of work per month, with four days off for general cleaning and inspection of slaughter machines and utensils. The proposed agribusiness will slaughter 700 animals daily, for 26 days/month, with an average weight of 350 g each animal, totaling 245 kg of live animal/day. During the slaughter process, approximately 29% of the animal is removed as waste (head and legs) and viscera, that is, there is a loss of approximately 73 kg. Table 1 shows the daily and monthly slaughter.

Table 01 – Daily/monthly slaughter at the frog slaughterhouse

DAILY/MONTHLY SLAUGHTER: 700 ANIMALS		
	Daily/Kg	**Monthly (26 days)/Kg**
Frog Unit (350 g)	245	6370
Meat (60%)	147	3822
Skin (11%)	26.95	700.7
Rejects/Viscera (29%)	71.05	1847.3

Investments for the implementation of the agroindustry included: civil construction, working capital, utensils for slaughter in general, vehicles for distribution, equipment in general and other expenses totaling R$258,265.58 plus Working Capital in the amount of R$133,165.71 , totaling R$391,431.29 with a planning horizon of 5 years, as shown in table 2.

Table 2 – Summary of Total Investment (R$)

Total Investment (Summary) (R$)		
Description of Investments	**Price R$)**	**(%)**
1. Fixed Investments	258,265.58	65.98
2. Working Capital	133,165.71	34.02

Total	**391,431.29**	
Sources of Resources	**Price R$)**	**(%)**
1. Own resources	391,431.29	100
Total	**391,431.29**	

Operating costs include expenses with raw materials, labor, packaging, taxes, energy, water, auxiliary materials and depreciation, totaling R$14,527.64 monthly. Table 3 shows the estimated monthly fixed costs.

Table 3– Estimate of fixed monthly operating costs (R$)

Estimate of fixed monthly operating costs (R$)	
Description	**Total Monthly Cost (R$)**
Electricity	2,000.00
Telephone	300
Accountant's fees	1,000.00
Cleaning material	100
Office supplies	50
Salaries and charges	15,512.40
Fuel	500
Depreciation	994.74
Total	**20,457.14**

The cost of direct materials or goods sold are the costs of the raw material (live frog). The amount paid by slaughterhouses to producers is currently approximately R$9.24/kg live animal. Table 4 shows the costs of raw materials/ month, totaling R$ 50,268.97.

Table 4 – Costs of direct materials and/or goods sold

Cost of direct materials CMD and/or goods sold CMV			
Product/Service	**Sales estimate (in units)**	**Unit cost of materials/Acquisition (R$)**	**CMD/CMV (R$)**
Housing Tray	2444	4.62	11,286.39
Thigh Tray	3172	4.62	14,654.64
Chopped Tray	2028	4.62	9,369.36
Viscera	1859	4.62	8,588.58
Skin	18200	0.35	6,370.00
	Total		**50,268.97**

Revenues were obtained through the sale of three types of frog meat trays: carcass tray, thigh tray and minced tray, in addition to the separate sale of viscera, waste, blood and skin, totaling R$204,163.70 per month in Total Revenue sales, according to table 5:

Table 5 – Estimated company's monthly revenue (R$)

Estimate of the company's monthly revenue (R$)			
Product/Service	**Amount**	**Sale price**	**Total Revenue**
Housing Tray	2,444	18	43,992.00
Thigh Tray	3,172	40	126,880.00
Chopped Tray	2,028	13	26,364.00
Viscera	1,859	0.3	557.7
Skin	18,200	0.35	6,370.00
	Total		**204,163.70**

Frog slaughter was done in a simple way. Slaughter employees (slaughter assistant) received prior training before starting slaughter activities. One of the assistants was trained by an Animal Scientist to work on the analysis part. General control of the slaughterhouse was carried out by the General Manager and the Administrative Assistant, who were responsible for all Administrative and Production aspects, including the purchase of quality raw materials. The company had a staff of six employees, with monthly expenses (salaries and charges) of R$15,512.40 as described in table 6:

Table 6 – Estimated labor costs

Estimation of labor costs						
Function	**No. of employees**	**Subtotal Monthly Salary (R$)**		**Charges social (%)**	**Charges Social (R$)**	**Total (R$)**
General manager	1	1,800.00	1,800.00	25.1	451.8	2,251.80
Aux. Administrative	1	1,200.00	1,200.00	25.1	301.2	1,501.20
Slaughter Assistant	3	1,000.00	3,000.00	25.1	753	3,753.00
Cook	1	1,000.00	1,000.00	25.1	251	1,251.00
Concierge	1	900	900	25.1	225.9	1,125.90
zootechnist	1	4,500.00	4,500.00	25.1	1,129.50	5,629.50
Counter	1	700	700	25.1	175.7	875.7
		Total				**15,512.40**

The necessary investment, operating costs, revenues and*payback.*

4 RESULTS AND DISCUSSIONS

4.1 Technical results

The slaughterhouse strictly followed the hygiene, sanitary control and quality standards required by the competent bodies, in order to provide products of the highest nutritional quality and thus gain the trust and satisfaction of its customers. All standards and requirements of environmental agencies will be observed so that the company does not harm the local environment. The product packaging states the importance of consuming frog meat and

its health benefits. The company was instructed to use SAC by telephone and a website where consumers can ask possible consumer questions, recipe suggestions and purchase/sale contacts.

According to Conama Resolution 385, the entrepreneur must present the following documentation: I – application for an environmental license;

II– project containing a description of the project, including its location, as well as details of the Pollution and Effluent Control system, accompanied by the Technical Responsibility Note – ART;

III– land use certificate issued by the municipality; It is

IV– proof of legal origin when the raw material is of extractive origin, when applicable.

Slaughterhouses must present, I – the maximum daily capacity of slaughter;

II – the system for collecting and disposing of blood from bloodletting; and III – the operation of the evisceration section.

The competent environmental body, after analyzing the documentation, will issue an express statement on the viability of the project's location and, if there is proof of low environmental impact and reduced production of effluents and waste, will grant the corresponding environmental licenses.

The proposed slaughterhouse will follow construction standards based on the Federal Inspection Service (SIF) and the MAPA Ministry of Agriculture, Livestock and Supply, which will allow marketing throughout the national territory and subsequently export.

Slaughterhouses and establishments that process fish will be licensed in two stages: I – Preliminary and Installation License – LPI, which authorizes the location and installation of the activity; It is

II – Operating License – LO, which authorizes the operation of the activity.

In the frog slaughter process, some actions were carried out in Ranário to obtain a quality final product. Standardizing the size of animals sent for slaughter was a fundamental premise for the raw material (live frog) to generate standardized products for the market. The animals were kept fasting in the period before slaughter, preventing the digestive tube from rupturing during evisceration and compromising the product through contamination, when coming into contact with the animal's gastric juice and feces. The fasting time was 36 to 48 hours. These steps were carried out in the Fattening Tank

in Ranário.

According to Beltrão (2008), “The water that supplies the slaughter room must be chlorinated separately with 10% sodium hypochlorite (50 ml / 1000L of water) or 2% bleach (250 ml / 1000L of water).” The equipment and instruments used in slaughter must be in perfect condition of use and cleanliness. It was also important that those responsible for this stage of the production cycle were enlightened people and aware of the importance of the hygiene factor. It is important to highlight that dehydration is a serious problem for these animals, in addition to the physical stress they are subjected to when transported. Stress before slaughter compromises the quality of the animal's meat. Figure 2 shows the slaughter flowchart.

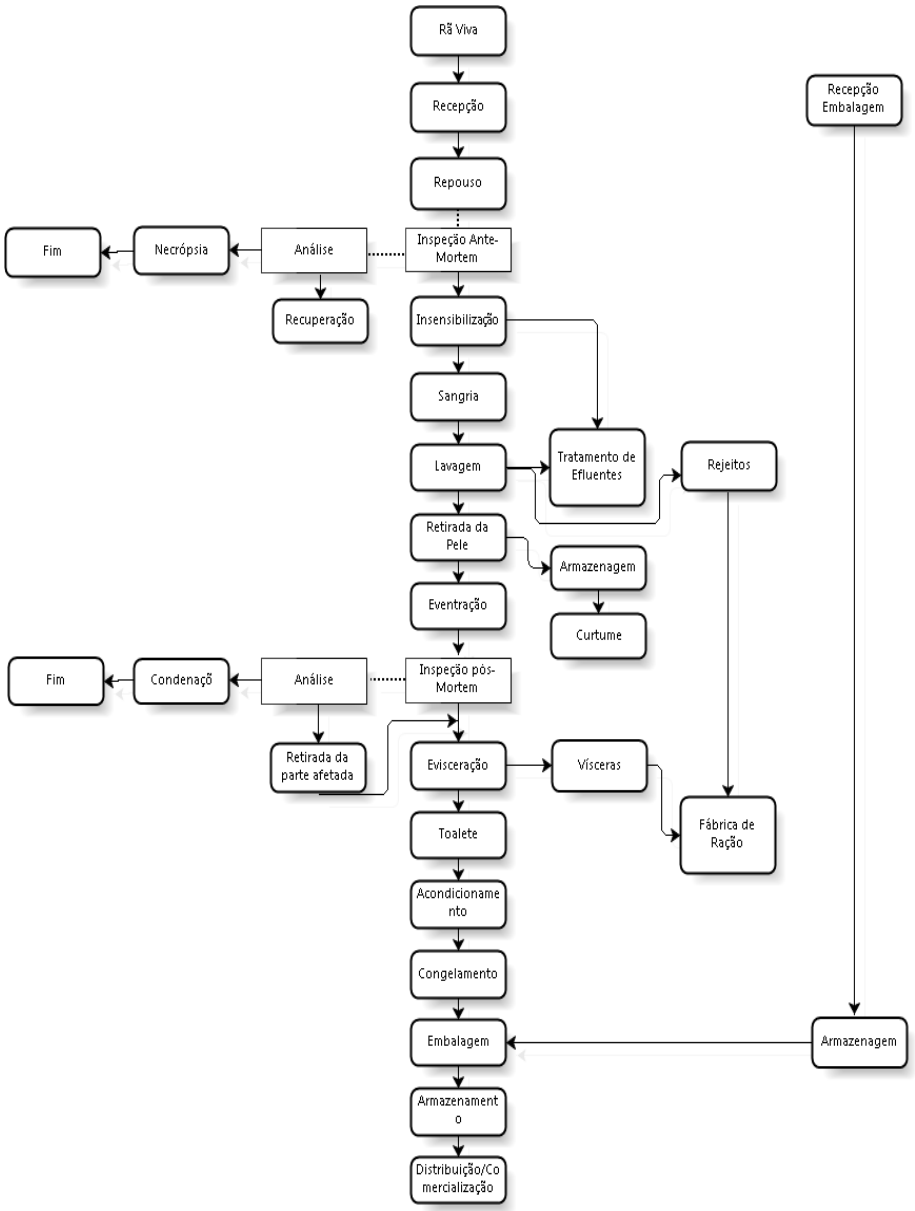

Figure 2: Flowchart of frog slaughter and processing, prepared by Donizetti, 1985 and adapted by authors.

According to Donizetti (1985*apud*LIMA, 2012) the phases of frog slaughter and processing are: reception, rest, inspection, stunning, bleeding, washing, skin removal, eventration, inspection*postmortem,*evisceration, toilet, conditioning, freezing, packaging, storage and distribution/marketing.

4.2 Financial Results

To reach the feasibility of the Plan, the items described in table 7 were calculated:

Table 7 – Income statement

Income statement	
Description	**Values (R$)**
1. Total Sales Revenue	204,163.70
CMD and/or CMV Costs	50,268.97
Sales Taxes	12,188.57
Sales expenses	2,041.64
Subtotal 2	64,499.18
3. Contribution Margin Index	0.68
4. Total Fixed Costs	20,832.84
5. TOTAL COST	**84,956.32**

Table 8 describes the viability indicators (gross and net profit) per month, profitability and profitability per year. In addition to the break-even point and payback time in years.

Table 8 – Feasibility Indicators

Viability Indicators	
Description	**Result**
Gross Profit (am)	R$133,437.59
Net Profit (am)	R$119,207.38
Balance point	R$ 29,904.05
Profitability (aa)	58.39%
Profitability (aa)	30.45%
Payback time (years)	0.27

O*payback*Its function is to show the recovery time of invested capital

calculated in a simple way, taking into account the time value of money in its calculation. Thus, according to the data presented in table 8, the Capital Recovery Time is 0.27 years, that is, approximately three and a half months, indicating the period of time that would be necessary to recover the invested capital, which shows that the investment is economically viable, with a quick return. In the following table, it can be seen that the project pays for itself in the first year of activity, with positive cash in the amount of R$ 1,039,057.27 for the next year.

Table 9 – Projection for the coming years (R$)

Projection for the coming years (R$)				
Year	Investments	Revenue	Expenses	Balance
Year 0	391,431.29	2,449,964.40	1,019,475.84	1,039,057.27
Year 1	-	2,449,964.40	1,019,475.84	1,430,488.56
Year 2	-	2,449,964.40	1,019,475.84	1,430,488.56
Year 3	-	2,449,964.40	1,019,475.84	1,430,488.56
Year 4	-	2,449,964.40	1,019,475.84	1,430,488.56
Year 5	-	2,449,964.40	1,019,475.84	1,430,488.56
				8,191,500.07

For the project to achieve the expected profitability, the activity must be carried out with all the technical support that an agribusiness requires. Well-trained professionals qualified to develop the activity, raw material suppliers committed to quality, observing the zootechnical requirements of animal production and management are some essential factors for the success of the enterprise.

The use of 100% of the animals in the slaughter activity is also one of the factors that increase profitability. Special care when removing the skin, correct conditioning of the viscera, waste and blood, observing the requirements of the industries that used this material are also essential, as waste can compromise profits.

5. CONCLUSIONS

Given the results obtained from the study, the economic viability of the project was evident, with a return on invested capital in approximately three and a half months, which is considered quite fast when it comes to an agro-industry.

Observing the great demand for frog meat, the implementation of agroindustry in the region would allow the expansion of the activity and consequently the strengthening of the frog meat production chain in the region, based on the fact that many producers stated, in an informal conversation

who do not invest in the activity due to lack of slaughterhouses, emerging as another business opportunity for small and medium-sized rural properties.

With a relatively low investment (R$ 391,431.29) and the slaughter of 700 animals/day, it is possible to set up a slaughter industry. Furthermore, the frog slaughterhouse can be adapted to slaughter fish during idle hours, which would further increase the company's profits.

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