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Technical And Economic Feasibility Of A Hydroponic Tomato Production Plant For The Production Of Dressings

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Abstract

One of the solutions that has sounded the most, in the economic activation of a country is the creation of companies, since it is considered that generating employment mitigates negative social, economic and environmental impacts, therefore, given these facts so inopportune for the economic development of the region and the capital city, the need to propose business ideas that innovate and offer a wide variety of solutions both economically and in meeting needs is born. Businesses are a fundamental boom for society, thanks to them the development, economic growth and quality of life of the inhabitants is visualized, there are different types of companies in the region, but they are not enough for the needs of the people. According to the above, this article will seek to make a design proposal and plant distribution for the production of tomato sauce, where the good use of resources will be available and will be projected as a pioneer company in this aspect and one of the first companies in the region of this type of food production, for this will begin with the location of the appropriate site from the study of macro and micro location, then the distribution of spaces and the necessary processes will be determined. Finally, the design of the industrial plant will be defined, which should be adjusted to the selected context in the manufacture of tomato sauce and thus contribute positively to the industry in the region.

Keywords: activity, standard, method, process, process, variable

1. Introduction

The high level of consumption and the satisfaction of human needs have become a determining factor for the food industries, thus intensifying the implementation and standardization of the processes of transformation of raw materials into foods with excellent levels of nutrients, vitamins or other properties.

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Leaving aside the use of chemicals or some components harmful to the consumer's health. The standardization of these processes has brought with it an inclusion of all internal sub-processes of the organization such as: Transportation, reception, facilities and infrastructure capacity, storage, processing, conservation, and customer service.

In Colombia, the food industry sector is on the right track, (Montes, 2019) Director of the ANDI Food Chamber stated that " the food industry grew 5.21% for the year 2019, observing a favorable projection for next year, i.e. 2020" This increase is partly due to the increase in the minimum wage and the purchasing power of each consumer, taking into account that the geographical and water extensions of the country are favorable for obtaining raw materials and inputs needed in the transformation processes. Taking into account the above, there is an opportunity to generate a proposal that benefits the region economically and socially.

Norte de Santander is lagging behind at the industrial level due to misuse of resources and lack of support from the government, which has generated a lack of opportunities and economic backwardness for the inhabitants of the region. Not to mention the international crisis and the migration of Venezuelan people in the capital city.

This is why there is a need to propose multiple alternatives and initiatives, such as the creation of companies developed from ideas of university students in the region, these young entrepreneurs seek not only to improve the situation of the region, but also to innovate the market with the implementation of innovative techniques and methodologies, which facilitate decision making and resource optimization.

Innovating implies the fulfillment of a multiple series of steps, in which the route of action of the new company must be planned, among these steps is the location and design of the facilities, since this is a factor that in most cases provides a competitive advantage, speeding up the production and delivery times of the product.this article sought to identify and recommend the locations, design, dimensions and distribution of a tomato sauce production plant, which in the future will be the solution to the problems already exposed.

2.Article structure

2.1 Research Background

Table 1. International, national and local background

Title	Description	Level	Authors	Source
Design of the tomato processing industry **(Thesis submitted for the degree of Agricultural Engineer**).	This project was based on the design of a tomato processing plant located in Caparroso (Navarra) in which dimensions were developed in the facilities that serve the production and the necessary spaces in the plant to carry out production and service activities. The contribution of this work to the development of the project was the identification of theoretical aspects related	**International**	(Sagredo Loitegui, 2015)	Repository Public University of Navarra

	to plant layout, identifying relevant characteristics in each one.			
Design of a tomato paste plant in Moche, Peru, with a sustainable development alternative. **(Research article, presented at the graduate school UCV. District of Víctor Larco Herrera, Perú)**	The purpose of this research project was to design a tomato paste production plant in the district of Moche, Trujillo, Peru, given the potential of the land for agricultural products, such as tomatoes. The plant design included: market research, plant sizing, project engineering, plant layout and location, and environmental impact assessment. The work provides information on the design of a plant, as well as the engineering of the project in terms of plant layout and location. It also provides important terminology regarding the concept of sustainable production, which is one of the essences of hydroponic cultivation.	**International**	(Mendez, 2013)	Science and Technology Magazine, Trujillo University of Peru.
Plant design proposal for the Dulcemia Gourmet company, to increase installed capacity. **(Work submitted for the degree of Industrial Engineer)**	The objective of the project was to make a plant design proposal to increase the production capacity of the company Dulcemia Gourmet, taking as a basis the most representative product lines of the company, since through them an improvement of the internal processes would be achieved and at the same time to appreciate improvements in the fulfillment times of the orders, increasing the customer - company relationship, which is important for the fulfillment of the goals set. By means of the simulations in PROMODEL, it is evident the decrease in the percentage of use of machines that at the beginning were part of the bottlenecks during the process and thus avoid overuse of machines. With the information obtained from this degree project, it is evident how an infrastructure proposal can be presented according to a future demand and therefore give a plant design to operate in the face of such demand. In addition, some factors related to the plant distribution are evidenced.	**National**	(Rivera, 2017)	Vitela institutional repository (Universidad Javeriana, Valle del Cauca)

Proposal of location, design and plant layout for a company producing Tectan sheets and tiles from recycled Tetra Brik. **(Work submitted to pass the course "Plant Design and Distribution")**	The work was structured based on the search for a lot in 3 different sectors of the department, in which some real and not real aspects were evaluated, from this the lot was identified, which favored the design of the production plant of tiles and sheets. The distribution was carried out according to current regulations and guidance from the teacher in charge of the subject. This work contributed to the development of the project, the methodological structure and the systematic development of each of the activities involved in the distribution and design of a new plant.	**Regional**	(Ortiz, Granados, & Quintero, 2019)	Francisco de Paula Santander University

2.1 Research theories

2.1.1 Technical Study. The technical study analyzes elements that have to do with the basic engineering of the product and process to be implemented, for which a detailed description must be made in order to identify all the requirements to make it functional (Navarro, 2013).

In short, a technical study identifies the aspects or factors (labor, raw materials, suppliers, movements, waiting times, etc.) involved in the design and distribution of the plant; the analysis of these factors is accompanied by previous macro and micro location studies. For (Navarro, 2013) an investment project must show, in its technical study, the different alternatives for the elaboration or production of the good or service, in such a way that the processes and methods necessary for its realization are identified.

This leads to the need for machinery and equipment for production, as well as skilled labor to achieve the objectives of product operation, the organization of spaces for its implementation, the identification of suppliers and vendors that provide the materials and tools necessary to develop the product optimally, as well as establishing an analysis of the strategy to follow to manage the capacity of the process to meet the demand during the planning horizon.

This provides a basis for determining production costs, machinery costs and labor costs. The first step in project evaluation is market research, which shows demand trends, based on the identification of the needs of actual and potential customers, the actual and projected supply of the product or service, as well as the marketing and determination of sales prices (Navarro, 2013).

2.1.1 Cash flow analysis. According to the International Financial Reporting Standards, the Cash Flow Statement is the one that gives a description of the inflows and outflows, which are part of the origins and application of the resources acquired in a period, i.e. it shows how cash is used at the time of performing investment, operation and financing functions (Suarez & Acevedo, 2019).

Net present value (NPV). For (Suarez & Acevedo, 2019). The Net Present Value method is that which is responsible for the incorporation of the time value of money and the determination of the net cash flows of a project, so that the correct comparisons can be made between the cash flows presented in the different periods over time.

The time value of money is associated with the interest rate, which is modified through the change that occurs in this over time, i.e. through the variation obtained by the rate from one period to another, the present value of the cash flows of a project can be determined. Taking into account the results obtained by the Net Present Value (NPV), it will be possible to determine how profitable or not a business or project is.

Internal rate of return (IRR). The internal rate of return of a business or project is equivalent to the following
to the interest rate that such business or project will give to the person who invested his or her money there.
(Suarez & Acevedo, 2019).The internal rate of return is the interest rate that makes the present value of the net operating cash flow equal to the present value of the net investment. The internal rate of return is the interest rate that makes the Net Present Value of the business or project cash flows equal to zero Calculation Methodology The Internal Rate of Return is determined by arbitrarily selecting an interest rate at which the Net Present Value of the business or project cash flows is calculated.

Variable Costs. These are costs that vary according to changes in activity levels, and are related to the number of units sold, volume of production or number of services performed, for example, raw materials, fuel, hourly wages, etc.

Fixed costs are costs that are not affected by variations in activity levels, for example, rents, depreciation, insurance, etc.

Break-even point. According to (Industrial, 2018) it is that point of activity (sales volume) where total revenues are equal to total costs, i.e., the point of activity where there is no profit or loss.

To find the break-even point is to find the number of units to be sold, so that the above (sales equal costs) is met. The same author defines the following steps to calculate the break-even point.

Define costs. First of all, we must define our costs. The usual way is to consider as costs all disbursements, including administration and sales expenses, but not including financial expenses or taxes.

Classify costs into Variable Costs (VC) and Fixed Costs (FC). Once we have determined the costs that we will use to find the break-even point, we classify or divide them into Variable Costs and Fixed Costs:

Find the unit variable cost. Third, we determine the Variable Unit Cost (Cvu), which is obtained by dividing the total Variable Costs by the number of units to be produced (Q).
Apply the break-even formula. The formula to find the break-even point

es:

$$(P \times U) - (Cvu \times U) - CF = 0$$

3. Method

According to (Martínez, 2014)), defines the concept as: Procedure used to describe the characteristics of the population to be studied. Along with comparative and experimental research, it is one of the three research models used in the area of science. This type of research does not involve the use of hypotheses or predictions, but the search for the characteristics of the studied phenomenon that interest the researcher.

The purpose is to analyze the organization of a business plan, according to new ideas to which the company is currently committed, in order to consolidate itself as a reference company in the commercialization not only of ferrous and non-ferrous materials, but also of waste such as archival paper, cardboard and PET plastic, and thus be able to advance in competitiveness, contributing to the strengthening of the company and the organization of new projects with useful information to dimension new requirements at the operational, administrative, technical, financial, strategic and legal levels.

The sample is the group of individuals taken from the population to study a statistical phenomenon that is extracted from the population.For the development three types of population are taken, 5 administrative people that correspond to 35% of the personnel of that area, 3 clients corresponding to paper, cardboard and PET plastic companies, these because they have a considerable representation in the production and commercialization at national level, additionally, a sample of 84 suppliers is taken, which correspond to 100% of those who currently supply the company, according to information from the experience of the current commercialization, it is evident that they are the suppliers that handle a considerable amount of material related to plastic, cardboard and paper. The research will be directed through historical data, in this way we will obtain a better overview and regularity at the time of proposing strategies that relate the company with new projects in society. In addition to this, an interview will be conducted with the manager and administrative staff, in order to know relevant aspects of the company and its capacity. On the other hand, suppliers and customers will be characterized, to obtain a clear vision of the interested party and thus be able to improve the factors in the future commercialization of the new market.

4.Results

4.1 Determination of production size.

In the definition of the production lot, some tomato pulp yield percentages were taken into account, which are presented below. This was used to determine the installed capacity and the raw material and machinery requirements.

According to the potential demand obtained, it was observed that the viable production lot of the company should initially be around 4000 units per day; however, the installed capacity should be 10000 units per day, since a margin of action should be maintained in the face of future market expansions. Taking into account this and the company's self-sustainability criteria, the capacity of the greenhouses and the need for tomatoes should be analyzed in the first instance in order to ensure the production and harvesting of tomatoes.

According to (Garizao, 2018), a good pasta contains the following percentages, which can be handled to the taste of the pasta maker

o °Brix= 20- 25
opH = 2.9 - 3.5
o% Fruit= 76% o% Fruit= 76% o% Fruit= 76% o% Fruit= 76% o% Fruit= 76
oSalt = 0.5 - 2% oSalt = 0.5 - 2% oSalt = 0.5 - 2%
oOnion = 1-5% oOnion = 1-5% oOnion = 1-5%
oGarlic= 0.5 - 1%.

oTomillo = 0.0 -0.3%.
oLaurel = 0.0 - 0.3%.
oOdour nail = 0.0 - 0.3%.
oCanela= 0.0 - 0.3% oCanela= 0.0 - 0.3%.
o Paprika chili= 0.0- 0.3%.
oSlow Pectin= 1g/kg - 5 g/kg
o Cmc= 0.0 - 0.1 %.
oAcetic acid : 6 - 16%.
o Starch : 3.5%.

According to (Garizao, 2018), for every 12 kg of tomato, the following quantities are added, according to the percentages stated above:

Table 2. Production of tomato sauce (Calculation base 12 Kg of gross Mp)

Production of tomato sauce (Basis of calculation 12 Kg of gross Mp)
Brix Tomato = 5 (these are the degrees normally possessed by the fruit)
Kg shell + seed + stalk = 1.4 Kg * each 12 Kg
Kg of pulp= 12 Kg - 1,4 Kg = 10,06 Kg
% Yield $= \frac{10.06\ kg}{12\ Kg}$ * 100 = 83,83 %
% Loss$= \frac{1.4kg}{12\ kg}$ * 100 = 11, 6 %
Kg of pulp after evaporation $= 10.06 \times \frac{50}{100} =$ 5, 03 Kg
Kg of pulp after evaporation $= 10.06 \times \frac{50}{100} =$ 5, 03 Kg
Kg product = 5.03 Kg * 100 / 76 = 6.61 Kg

- ✓ Brix Tomato = 5 (these are the degrees normally possessed by the fruit)
- ✓ Kg of tomato= 12 Kg
- ✓ Kg shell + seed + stalk = 1.4 Kg * each 12 Kg
- ✓ Kg of pulp= 12 Kg - 1,4 Kg = 10,06 Kg
- ✓ % Yield $= \frac{10.06\ kg}{12\ Kg}$ * 100 = 83,83 %
- ✓ % Loss$= \frac{1.4kg}{12\ kg}$ * 100 = 11, 6 %
- ✓ Kg of pulp after evaporation $= 10.06 \times \frac{50}{100} =$ 5, 03 Kg

The values highlighted in yellow are of great importance for the definition of the demand, since the rest will be structured on the basis of these values.

Additives

$$\mathbf{kg\ de\ sal} = 7.15 \times \frac{0.8}{100} = 0.0572\ \text{kg}$$

$$\mathbf{kg\ de\ cebolla} = 7.15 \times \frac{3}{100} = 0.2145\text{kg}$$

$$\mathbf{kg\ de\ ajo} = 7.15 \times \frac{0.5}{100} = 0.035\text{kg}$$

$$\mathbf{kg\ de\ tomillo}, \mathbf{canela}, \mathbf{clavo\ y\ laurel} = 7.15 \times \frac{0.11}{100} = 0.0078\text{kg}$$

$$\textbf{kg de aji pimenton} = 7.15 \times \frac{4}{100} = 0.28\text{kg}$$

$$\textbf{kg de pectina} = 7.15 \times \frac{1g/kg}{1000} = 0.0071 \text{ kg}$$

$$\textbf{kgde CMC} = 7.15 \times \frac{0.08}{100} = 0.00572\text{kg}$$

$$\textbf{kg de almidón} = 7.15 \times \frac{3.5}{100} = 0.25025\text{kg}$$

$$\textbf{kg de ácido acetico} = 7.15 \times \frac{11}{100} = 0.786\text{kg} \approx 786 \text{ g}$$

$$\textbf{kg de azúcar} = 7.15\left(\frac{18}{100}\right) - 5.437\left(\frac{9}{100}\right) = 0.797\text{kg}$$

$$\textbf{kg de colorante rojo punzon} = 7.15 \times \frac{30}{1000000} = 2.145 \times 10^{-4}\text{kg}$$

$$\textbf{kg de picante} = 7.15 \times \frac{0.3}{100} = 0.02145\text{kg}$$

$$\text{kg de } H_2O = \text{kg de producto} - \sum \text{kg de solidos}$$

$$\text{kg de } H_2O = 7.15 \text{ kg} - (5.437 + 0.0572 + 0.2145 + 0.035 + 0.280 + 0.071 + 0.00572 + 0.25025 + 0.786 + 0.797 + 2.145 \times 10^{-4} + 0.02145)\text{kg}$$

$$\textbf{kg de } \mathbf{H_2O} = -0.75\text{kg}$$

Note: to find the kg of water, the kg of spices were not taken into account, since the value of these is very small.

To determine the production of the plant we must know the characteristics and properties of this type of hydroponic cultivation, for this reason we extracted information from books related to the subject. According to (Velasquez, 2008) the soil and climate requirements of a hydroponic pear tomato crop are as follows:

Table 3. Production of tomato sauce (Calculation basis 12 Kg of gross Mp)

Temperature: During the day it should be between 20- 30 C and at night between 1 - 17 C.
Relative humidity: 60 - 80 %.
Planting spacing: 2 m between rows and 50 cm between plants.
Light requirement: 6 - 8 hours per day
Average weight of fruit (g/unit): 170 g
Average units per plant: 28
Plant life = 6 months
Time to harvest = 35 days
Number of harvests * plant = 3

Once the dimensions of the greenhouse and the daily production requirements were identified, based on the consumption levels obtained in the real demand, which were calculated as follows. It is important to remember that the two presentations of the product are 350 g and 1000 g.

Actual demand: 4000 units per day

% freedom of first production: 35

Units to be produced per day: 4000 - 4000*0.35 = 2600 units

Initially, 60% of the production will be of the 350g reference (1560 units) and the rest of the 1000g reference (440 units), all this thinking of offering the most economical product possible. Once all these concepts are known, we proceed to calculate the amount of materials, raw materials and machinery required to meet this production.

The procedure for the calculation of production costs was carried out in several phases. In the first phase, with the information already obtained, the infrastructure needs and the net quantities of raw material were identified according to the information already obtained, all this will be grouped in tables which will show the most relevant information of each one, the machinery was shown in technical data sheets and the inputs in a table. Once all these concepts are known, we proceed to calculate the amount of materials, raw materials and machinery required to meet this production.

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Table 4. Raw Material and Infrastructure Requirements

Quantity of fruits obtained per bush : 25 fruits
Greenhouse capacity (bushes) = 300 bushes
Greenhouse capacity = 7500 fruits
Average fruit weight = 170 g
Non-optimal raw material, with a 5% error % on the total fruits = 375 fruits per greenhouse. (This data was based on information obtained by (Copoica, 2006)**.**
Kg of raw material per greenhouse = 7125 fruits * 170 g*Fruits = 1211 Kg
Kg of raw material obtained free for the process : 1211 Kg * 83.83 %= 1015 Kg
Kg raw material after evaporation: 1015 Kg * 0.50 = 508 Kg (net kilograms per greenhouse)
Kg of final product = 508 Kg * = 668 Kg $\frac{100\ g\ de\ tomate}{76\ g\ pulpa}$ **= 668 Kg**
Kg required Ref. 1 = 1560 units * 350 g = 546 Kg
Kg required Ref. 2 = 440 units *1000 g = 440 Kg
Total Kg required per day = 986 Kg
Greenhouses required to meet daily production = 986 Kg / 508 Kg = 2 greenhouses
Greenhouses for monthly production = 20 days worked per month * 2 = 40 greenhouses
Reserve greenhouses= 10 greenhouses
Total greenhouses = 50 Greenhouses

The prices established in this table are based on Corabastos' daily bulletin.

Table 5. Raw material cost

Raw materials	Quantity	Cost per Kg (COP)	Total
Tomato	1211 Kg		1,453,200
Sugar	74.5 Kg	139,000 * 50 KG bag	207,110
Salt	5 Kg	54,900 * 50 Kg package	5490
Nail	24, 5 Kg	Gram at $ 165	4,042,500
Laurel	24.5 Kg	Gram at $ 435.71	10,820,000
Cinnamon	24.5 Kg	Gram at $ 186.33	4,557,000
Paprika chili	27 Kg		67,500
Garlic	3.34 Kg	2400	30,000
Onion	20 Kg	Bulk 50 Kg at $ 180.000	72,000
Acetic Acid	77,2 L	Glacial Acetic Acid Ra Acs X 2.5 L - 9508-05 - Jt Baker at $131.527	4,077,337
Total costs			25,332,137

Although it is known that the amount of machinery necessary to carry out the production process is a data that standardizes in a certain way the design and distribution of the plant, the costs necessary for the purchase of this equipment is a representative value that serves for the economic analysis of the project, since it is possible to stipulate how profitable it is to buy or build the factory. The machines, their respective quantities and the total value of the investment are shown below.

Table 6. Machinery cost

Machine	Image of the machine	Quantity	Cost (Ds)	Total (Ds)
Sorting table				**2000**
Vegetable Pressure Washer.			**1000**	**2000**

Homogenizing machine, emulsifying machine		**5**	**9800**	**49000**
Blancher				**8000**
Shredder			**2000**	**6000**
Vacuum packing machine		**1**	**10000**	**10000**
Packaging machine		**1**	**3000**	**3000**

Conveyor belt				**1400**
Total investment in Ds			**81,400 Ds or COP 307,285,000**	

The salaries of the members of the tomato sauce plant organization were evaluated according to the importance of the position in the production chain.

In order to carry out the job evaluation, a comparison of the factors is made in each of the positions held by the organization; this allows us to standardize the hierarchical levels. This methodology was chosen because the concepts of both the point system and the factor comparison method are unified, that is, factors are incorporated to the point system and it consists of choosing several factors or competencies according to the needs of the organization and then giving a weight or weighting to each factor to estimate its relative importance and assign salaries seeking internal equity.

For the determination of the factors, the mission, vision and corporate values of the company are taken into account, adjusting them to the reality of each position in terms of their responsibilities and activities. For this purpose, the following is taken into account:

Each factor has a scale in its qualification for which sub factors are defined; the same that have a determined score between a maximum and a minimum value.

The factors allow us to identify and differentiate the value between each of the positions. The purpose of establishing sub factors will be to differentiate the different levels that the same factor can present in the different positions of the company. The factors to be used are the following:

-Labor responsibility

-Working conditions

-Knowledge and skills

-Work effort

Points will be awarded on the basis of 1% of the current legal minimum wage, the free value of the transportation allowance, i.e. ($ 877.802COP) 1, therefore 1 point = 8778 COP.

According to this and the provisions of the law, what the company must pay monthly is:

Table 7. Labor cost

PAYROLL ACCRUALS PAYABLE BY THE EMPLOYER	
Net Paid	$ 35981022
Pension contributions	$ 4.317.723

Health contributions	$ 3.058.387
Contributions to labor risks	$ 187.821
Seine	$ 719.620
ICBF	$ 1.079.431
Compensation funds	$ 1.439.241
Service premium	$ 1.271.439
Severance	$ 36.086.098
Interest on severance payments	$ 4.330.332
TOTAL, PROVISIONS	**$ 52.490.091**

Production costs are nothing more than a reflection of the determinations made in the technical study, i.e. all those elements that interfere in the production of the product such as labor, raw materials, electric power costs, water costs, gas, maintenance, depreciation and amortization (these are costs that treat and have the effect of a cost, without being a cost. To calculate the amount of the charges, the percentages authorized by the tax law in force in the country are used).

Raw material costs and quantities are described below.

Table 8. Raw material costs

Raw Materials	Quantity	Cost per Kg (COP)	Total Monthly (COP)	Total annual (COP)
Tomato	1211 Kg		$1.453.200	$17.438.400
Sugar	74.5 Kg	139,000 * 50 KG bag	$208.500	$2.502.000
Salt	5 Kg	54,900 * 50 Kg package	$5.490	$65.880
Nail	24, 5 Kg	Gram at $ 165	$4.042.500	$48.510.000
Laurel	24.5 Kg	Gram at $ 435.71	$10.820.000	$129.840.000
Cinnamon	24.5 Kg	Gram at $ 186.33	$4.557.000	$54.684.000
Paprika chili	27 Kg	$2.500	$67.500	$810.000
Garlic	3.34 Kg	$2.400	$24.048	$288.576
Onion	20 Kg	Bulk 50 Kg at $ 180.000	$72.000	$864.000
Acetic Acid	77,2 L	Acetic Acid X 2.5 L at $ 131.527	$4.077.337	$48.928.044
Total, costs			**$25.327.575**	**$303.930.900**

For labor, the following monthly payroll costs were obtained

Table 9. Raw material costs

PAYROLL ACCRUALS PAYABLE BY THE EMPLOYER		
Concept	**Monthly Cost**	**Annual Cost**
Net Paid	$35.981.022	$431.772.264
Pension contributions	$4.317.723	$51.812.676
Health contributions	$3.058.387	$36.700.644
Contributions to labor risks	$187.821	$2.253.852
Seine	$719.620	$8.635.440
ICBF	$1.079.431	$12.953.172
Compensation funds	$1.439.241	$17.270.892
Service premium	$1.271.439	$15.257.268
Severance	$36.086.098	$433.033.176
Interest on severance payments	$4.330.332	$51.963.984
TOTAL, PROVISIONS	**52,490,091 COP**	**1,061,653,368 COP.**

Other production costs are described below

Table 10. Consolidated indirect costs

CONSOLIDATED INDIRECT MANUFACTURING COSTS (CIF)							
Concept	**Unit of measure**	**Unit value (month)**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Electric power	KW-h	$722	$3.924.792	$4.317.276	$4.749.000	$5.223.900	$5.746.284
Aqueduct	M3	$1.362	$8.172.000	$8.989.200	$9.888.120	$10.876.932	$11.964.624
Sewer	Fixed charge	$32.416	$3.889.920	$4.278.912	$4.706.808	$5.177.484	$5.695.236
Telephone-internet	Fixed charge	$103.900	$12.468.000	$13.714.800	$15.086.280	$16.594.908	$18.254.400
Equipment maintenance	Fixed charge	$100.000	$14.400.000	$15.840.000	$17.424.000	$19.166.400	$21.083.040
Total C.I.F.			**$42.854.712**	**$47.140.188**	**$51.854.208**	**$57.039.624**	**$62.743.584**

The projected depreciation for the company is as follows

Table 11. Depreciation Projection

Concept	Annual depreciation	Total depreciation (5 years)	Salvage value
Machinery	$30.728.500	$153.642.500	$153.642.500
Terrain	$50.000.000	$250.000.000	$1.200.000.000
Computers	$1.400.000	$7.000.000	$1.000.000
Office equipment	$1.600.000	$8.000.000	$1.600.000
Greenhouses	$25.710.792	$128.553.961	$0
Construction and buildings	$14.000.000	$70.000.000	$150.000.000
Vehicles	$10.000.000	$50.000.000	$50.000.000
Containers, packaging and tools	$1.400.000	$7.000.000	$0
Total	**$134.839.292**	**$674.196.461**	**$1.556.242.500**

The initial investment comprises the acquisition of all tangible and intangible assets, which can be obtained on a fixed or deferred basis, with the exception of working capital.it is important to note the difference between a tangible asset which is everything that can be touched, such as land, buildings, machinery, equipment, furniture, transportation vehicles, tools and others.

While an intangible asset are all those assets owned by the company, necessary for the operation of the company, some of these may be invention patents, trademarks, commercial or industrial designs, trade names, technical assistance or technology transfer, pre-operational, installation and start-up expenses, service contracts, studies that tend to improve in the present or in the future the operation of the company, such as administrative or engineering studies, evaluation studies, training of personnel inside and outside the company, etc. (Urbina, 2015).

The investments made in the project are as follows.

For hydroponic crops there will be an initial investment of $ 40,000,000 COP, which stipulates the equipment and tools to carry out the installation, equipment and tools. The investment for the construction of the plant and purchase of materials is around the value of $ 200,000,000 COP, it is important to note that there are other costs indirectly related to production such as energy consumption, water, among others, however it should be noted that the administrative costs will not include the lease factor, since the lot will be acquired directly.

The summary of the initial investment is described below.

Table 12. Total investment

Concept	Initial investment
Raw materials	$25.327.575
Hydroponic crops	$40.000.000
Construction	$200.000.000
Machinery	$307.285.000
Terrain	$1.000.000.000
Greenhouses	$180.047.565
Contingencies 5	$ 87.633.007
Total	**$1.840.293.147**

Before calculating the break-even point, it is important to know that it must be calculated separately for each reference, which is important when determining Q (Minimum viable production quantity). At the beginning of this project, demand was calculated and gave 75460 for the first year; however, the quantities sold vary according to the frequency of customer purchases, which is why the following aspects were concluded.

Reference demand 1000 g = 75460 Customers * frequency of purchase 1 unit per quarter *4 quarters = 301840 units per year

Reference demand 350 g = 75460 Customers * frequency of purchase 1 unit bimonthly *6 bimonthly = 452760 units per year

For reference 350 g:

Table 13. Equilibrium reference point 350 g

Cup	Unit cost to produce	Demand	452760
Pv	Sales price	Utility	
Mc	Contribution margin	Variable Costs	$1.430.038.980
CT	Total Cost	Fixed Costs	$271.881.548
CV	Variable Cost	Total cost	**$1.701.920.528**
CF	Fixed Cost		
Q	Quantity of units I need to manufacture		
Cup=	CT/Demand	$3.759	
Utility=	CT x 40	$680.768.211	
Pvu=	(TC + Profit)/Demand	$5.263	
Cvu=	CV/D	$3.158	
Q=	CF/(Pvu-Cvu) (Units)	129215,4735	
INCOME	Q x Pvu	$680.007.628	

For the 1000 g reference: In this reference, the profit rate is higher, since its purchase frequency is very low, the aim is to obtain as much income as possible.

Table 14. Equilibrium reference point 1000 g

Cup	Unit cost per prod	Demand	301840
Pv	Sales price	Utility	50%
Mc	Contribution margin	Variable Costs	$1.430.038.980

CT	Total Cost	Fixed Costs	$271.881.548
CV	Variable Cost	Total cost	**$1.701.920.528**
CF	Fixed Cost		
Q	Quantity of units I need to manufacture		
Cup=	CT/Demand	$5.638	
Utility=	CT x 40	$850.960.264	
Pvu=	(TC + Profit)/Demand	$8.458	
Cvu=	CV/D	$4.738	
Q=	CF/(Pvu-Cvu) (Units)	73086,63217	
INCOME	Q x Pvu	$618.146.897	

Financial ratios. In the financial ratios, the statement of income, which is shown below, was made for each reference.

Reference 350 g:

CONCEPT	**Reference 350 g**
Revenues	$ 680.007.628,27
Production costs	$ 255.511.670,28
Costs Administration	$ 137.042.256,00
Cost of sales	$ 21.600.000,00
Income before income tax	$ 265.853.701,99
Tax 34% tax	$ 90.390.258,68
Profit after taxes	$ 175.463.443,31
Depreciation	$ 134.839.292
Net income for the year	$ 1.760.708.250,81

5 Conclusions

The company has a very good capacity in its suppliers, which allows it to always have the largest amount of materials and elements to market, however it is evident the large number of small suppliers, in the future these do not provide an important help in meeting the demand since the market is very demanding and the quantities demanded are very high; with this it is proposed to the company to make strategic agreements with other suppliers with an even greater capacity.

It can be determined that the unit sales price can reach 623,550 COP per ton for each of the 3 products that the company wants to distribute, it is important to highlight that the company should sell all its units at this price; this does not resemble reality since there are much lower sales prices; with this break-even point the company should at least have a demand of 2334 tons per year, to keep the margin, everything higher than this amount will represent profits in the same.

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Makalenin Türkçe başlığı buraya yazılır....

Özet

Türkçe özet.

Anahtar sözcükler: anahtar sözcükler1; anahtar sözcükler2; anahtar sözcükler3

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