



# Implementation of a costing system in a dairy company

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In this study we will make the calculation of the different production costs that the company Lacteos Els Masets has throughout its production process, distributing them in an orderly manner in different departments, to later compare where most of the costs occur and find a way to try to minimize them as much as possible and thus expand the profit margin of the company without increasing the cost of sale, risking the lost of the customer base.

Keywords: cost, milk, milk, department, warehouse, yogurt

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## 1. Presentation and Introduction of the company

### 1.1. History of the company:

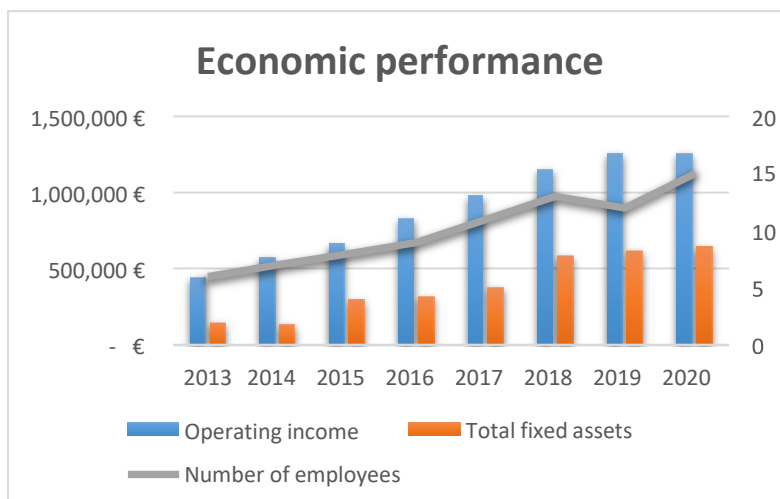
I have chosen the company Lácteos Els Masets for my final thesis because it is a company located in my hometown and second home. I also have direct contact with the director of the accounting department and part of the staff of workers, who can provide me with some of the information I need to do this task. In addition, I think that this company is booming and my work can help them to improve their costing system, and thus, better manage their resources.

Lácteos Els Masets is a family business, close to the customer, specialized in the traditional care of sheep and in the production of milk, in addition to its subsequent packaging and handmade elaboration of dairy products of the highest quality.

Their specialty has always been sheep farming for meat production, but in the year 2000 they changed the type of livestock to a Lacune breed of cattle. The genetics of this breed is characterized by the quality of its milk being very high in fat and protein.

In 2009 they began pasteurizing sheep's milk for sale in the hotel and catering industry (Els Masets, 2022). Shortly after, they started with the production of yogurts and curds, all of them with different flavors and textures, such as chocolate, nougat, coffee, lemon, tangerine, strawberry yogurts... Finally, today they have an offer of more than fifteen different products.

**Graph 1: Economic evolution Lácteos els Masets**



Source: Own elaboration based on data obtained from SABI.

As we can see in Graph 1, in the last 8 years the company has had quite a remarkable economic growth, from a turnover of less than 500,000 Euros to a turnover of more than 1,250,000 Euros last year.

Additionally, we can see in the graph how over the years, these revenues have been increasing considerably until 2018, when the coronavirus crisis affected, like the vast majority of companies worldwide, their financial income. This lower increase in revenues was mainly due to the closure of the schools and, as a consequence, of their canteens, since these are one of the main pillars of their revenues.

As for the fixed assets figure we can see that there has also been a considerable increase, tripling its figures in less than 8 years, this is due to various expansions they have made in the company to be able to increase their production and, therefore, their sales. In 2018 they carried out an expansion of the production area due to the lack of space to store the cheeses and the inability to supply goods to all their customers. Another notable increase that took place in 2020 was due to the purchase of a piece of land located in Morella which they have conditioned for cow farming and subsequent milk extraction.

On the other hand, we can observe how the number of workers (right vertical axis of Organizational Chart 1) has been gradually increasing over the years, hand in hand with the company's economic growth, although with a small decrease in 2019, also triggered by the coronavirus crisis.

Since 2016, the company has been giving guided tours (El Periódico Mediterráneo, 2016) to groups of friends and families, so that they can see firsthand how their different products are made and learn more about their product. In the area surrounding the factory there is also a wide variety of animals, in addition to the all-important sheep, to keep children entertained during the visit.

## **1.2. Company location**

This company is based in Torre d'en Besora, a small village of only 150 inhabitants, in the interior of the Maestrat region, Castellón. Here you can find the production of sheep's milk and the pasteurization of the different products of sheep's milk, cow's milk and goat's milk.

## Image 1. Company location



*Source: Own elaboration*

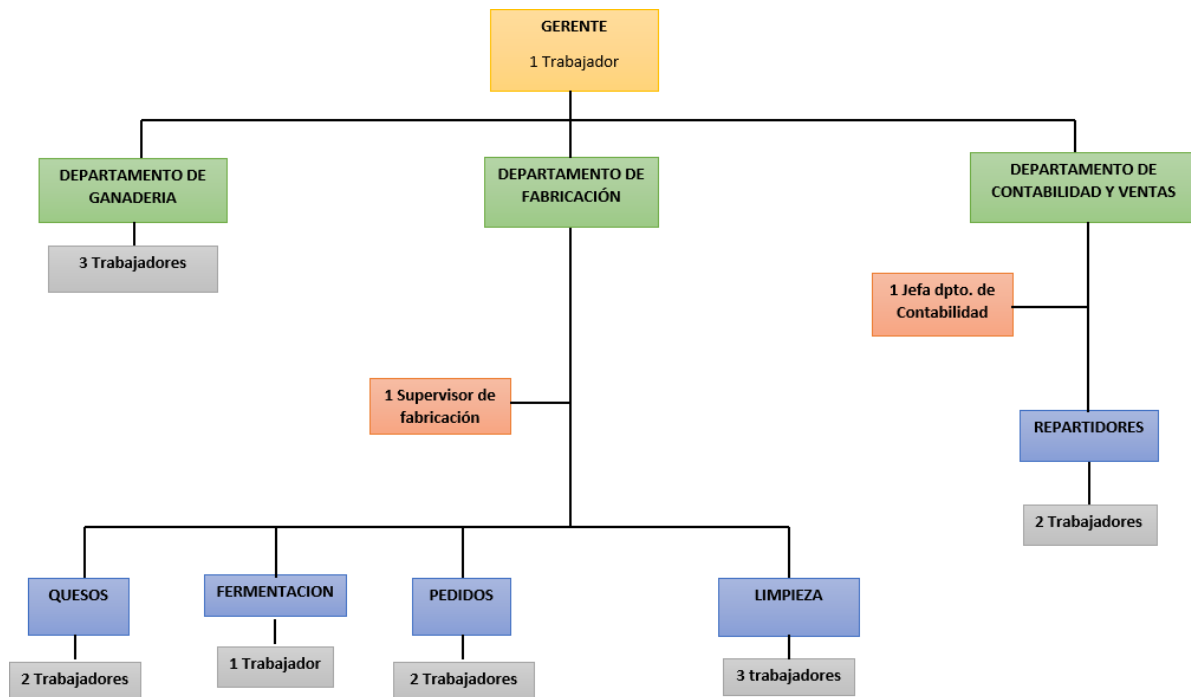
In this image we can see the image from a drone perspective of the sheep farm next to the land that can be seen on the left side of the road, where the sheep, which at that time are not to be milked, are removed so that they can be calmer in the open air and feed on grass. You can also see the factory where the entire production process takes place.

Recently, they have opened a small cow farm near Morella in the Masía Torre Escuela, for the production of cow's milk and to expand their portfolio with products made with such milk and reach a larger number of customers. In this farm there are cows of the Holstein breed, these are characterized by their high milk production and their ability to withstand low temperatures.

### **1.3. Employee organization chart**

Their entrepreneurial spirit, together with their interest in revitalizing and repopulating the rural area in which they live, has always made their growth nothing more than a natural evolution to the point where they are now. Without ceasing to be a family business, they have a staff of 16 workers and all of them reside in the region.

## Organization chart 1: Employees of the company Lacteos els Masets



Source: Own

In Organizational Chart 1 we can see how the workers are distributed in such a way that: The livestock department employs three people who are in charge of milking the sheep up to twice a day.

The manufacturing department is managed by the manufacturing supervisor, who is in charge of supervising that the whole department follows its course properly. In the cheese and orders section, two people work in each one, they are in charge of manufacturing the cheeses and organizing the different products in batches depending on the routes to be followed by the deliverymen, respectively. In the fermentation section there is a worker who is in charge of mixing the ferments, sugar and the different aromas depending on the flavor to be prepared in that batch, as well as carrying the containers with the mixture previously made and transporting and organizing them in the fermentation chamber, and, finally, removing them from the chamber once they are already fermented. The cleaning team is made up of three workers who are responsible for ensuring that the entire factory is at optimum levels of hygiene for a better quality of the final product.

Finally, in the accounting and sales department, it is managed by the head of the accounting and sales department, who is in charge of calling the various customers and consulting the orders on a weekly basis, then organizes the delivery drivers into routes to optimize the time and efficiency of the deliveries.

#### **1.4. Strategies used by the company**

During its time in the market, Lácteos Els Masets has followed the product differentiation strategy, which consists of differentiating the offer of its products with the objective of satisfying the desires of two or more segments with two or more products. This strategy is used with the objective of attracting customers with a medium-high purchasing power who are willing to pay a little more money to enjoy a higher quality product (Bachero, 2016).

On the other hand, the company has the certification that its products are kilometer 0, that is, the milk is extracted from its own sheep located next to the place where the yogurt and cheese curds are produced. This proves that its products are more environmentally friendly than those of its competitors who do not have this label.

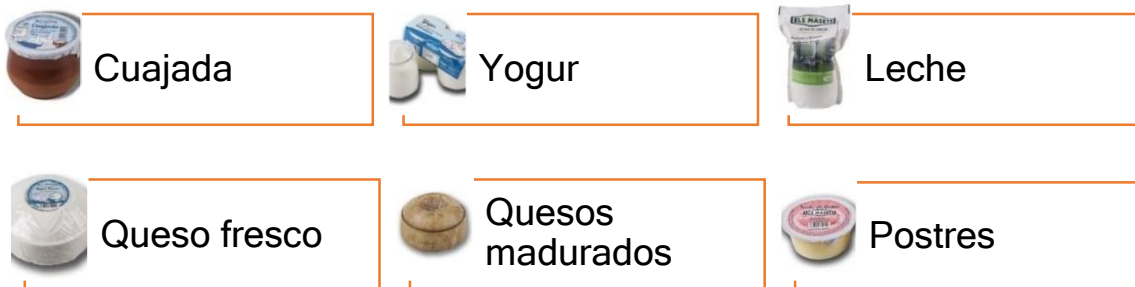
#### **1.5. Product lines**

Through the exploitation of sheep's milk Lácteos Els Masets has carried out the development of different product lines, such as yogurts, curds and cheeses. In addition, to give a wider range of products are made with sheep's and goat's milk to suit the tastes of more consumers, also offer yogurts of different flavors, strawberry, lemon or natural, as for the curds have different flavors such as nougat, coffee, chocolate, natural or sweetened, on the other hand, the cheeses can be cured, semi-cured or fresh.

With this large number of products, the company is trying to attract as many customers as possible and gradually make itself known to more and more people, in order to maximize its sales and thus its income.



**Image 4: Products els masets.**



*Source: Own*

Although there are many more products available to the consumer, the ones shown in the image are the best known and most consumed by customers.

### **1.6. Production Process**

The production process of the production chain of the company Lácteos Els Masets begins with the extraction of the raw material from the sheep located 50 meters from the place of manufacture, in order to provide the highest possible quality in their products, and provide a higher hygienic quality. This is the fundamental part to elaborate any of the food products such as curds, cheeses and yogurts.

Milk is one of the most consumed dairy products, but it can be further transformed and elaborated into a series of other dairy products of high nutritional value and high in protein.

On the one hand, milk fermentation is one of the production processes in this industry that consists in the use of specific microorganisms to reach the desired level of acidity, where the final product is yogurt.

Depending on the curing time given to the cheeses, they will be fresh, semi-cured or cured cheeses, and depending on the curing time, their flavor will be more or less intense.

Another process that can be performed on the milk, is done by means of an enzyme called ferment lab or rennet that has the property of coagulating the casein of the milk. During this process the temperature is a determining factor, this must be between 35 to 55 degrees Celsius, when the milk reaches this temperature it is mixed with the rennet and it is left to take effect.

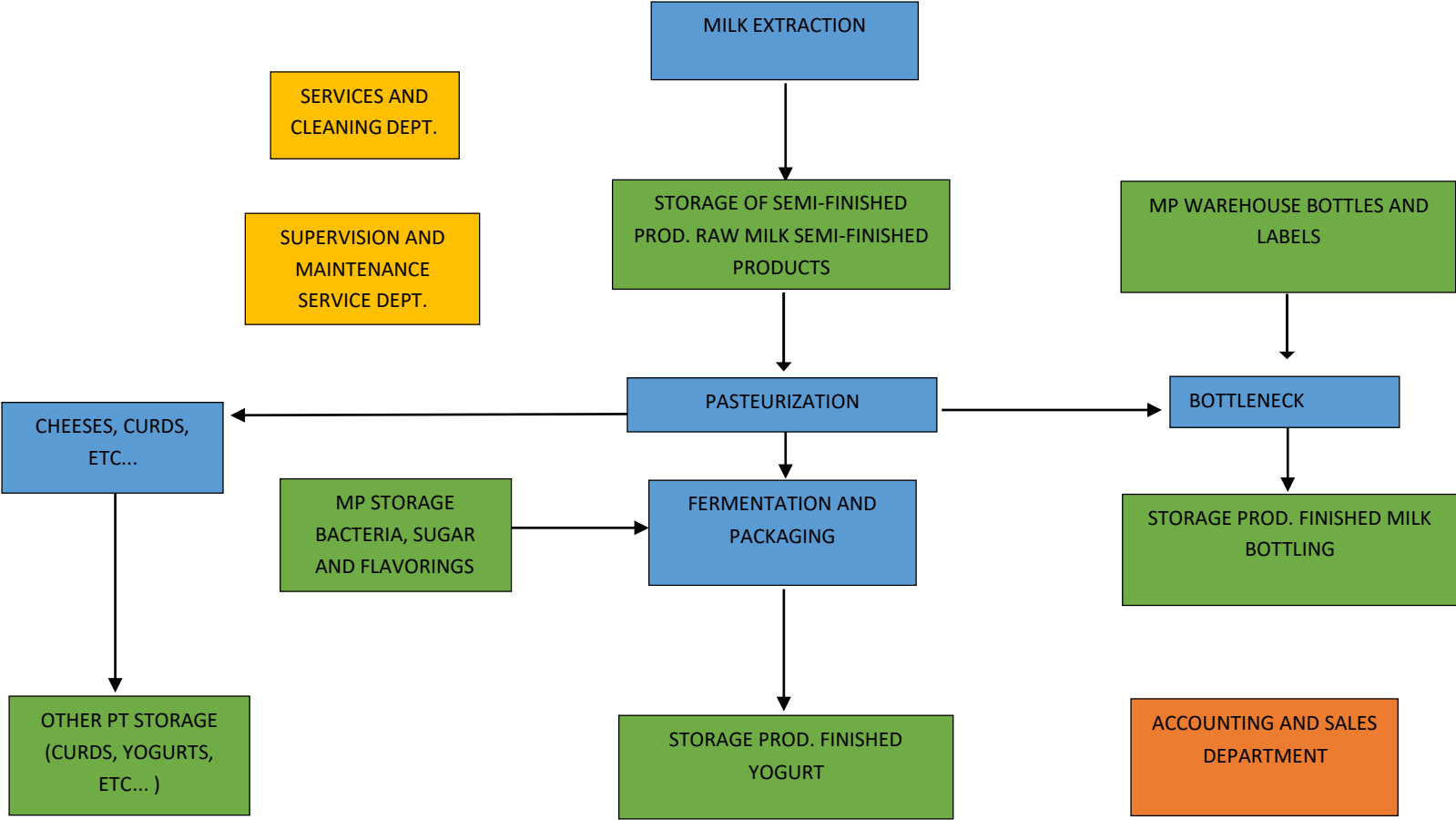
Other products that can be made with milk can be cottage cheese, which is a product obtained from the fermented whey of cheese and is a product rich in protein, low in fat and rich in vitamins and minerals. It can also be used to make one of the star products of dessert lovers, the famous cheesecake.

## **2. Identification of the company's costs**

### **2.1. Yogurt production flow chart**

As we can see, this is the organization chart of the yogurt production process, of the whole milk bottling, in addition to the other existing departments in the company Lacteos els Masets, through which we will carry out the costing system. For the sake of simplicity in this analysis we will only focus on the departments of bottling, fermentation and packaging of yogurts. With which we will observe in detail the costs of this production process and thus, have a better control and management of the costs of each department used in the process. Subsequently, we will try to improve the productivity and efficiency of the costliest departments, in order to increase the total profit margin of the company.

**Flowchart 2: Yogurt production flowchart**



Source: Own elaboration

## 2.2. Production phases

### 2.2.1. Milk extraction

At the beginning of the milk production phases begins on the farms, the sheep is responsible for producing all the raw material of the company, but in order to process this milk we must first extract it by milking, currently to facilitate this process, and not having to milk by hand ewe by ewe and gain productivity in the process, has implemented the use of milking machines which by suction suckers extract milk from the sheep, At Lácteos Els Masets they have a machine that extracts milk from 25 ewes at a time, the employees in charge of this phase of the process must direct them in groups so that they are all milked up to twice a day without any of them being milked more than once, although it is a very costly and patient process because the ewes are sometimes not easy to introduce into the milking machine, it is essential for the rest of the production process.

Currently, the farm has a total of 800 ewes, although for more specific reasons such as some ewes are still too young to start milking or are currently pregnant or in the process of being pregnant soon, among others, only 330 of the 800 ewes are being milked. Therefore, the workers of this department must fill the milking machine, as we can see in the picture, about 14 times in the morning and 14 times in the afternoon. All this makes up the first phase of production of all the products that are produced in the factory.

**Figure 5: Milking machine**



*Source: Own elaboration*

Then, the milking machine itself, through a hose, transports the extracted milk to specialized tanks where possible impurities from the milking process are eliminated, in addition to keeping it at a cold temperature so that it does not spoil, and it is kept waiting to be pasteurized.

In this section, we can find the following production costs, among others:

- Depreciation of other property, plant and equipment (sheep)
- Raw Materials (RW) sheep feed costs (water and feed)
- Direct labor (employees of the department)
- Indirect labor (supervisor)
- Depreciation of machinery (milking machine)
- Amortization Farm
- Supplies (electricity)
- Maintenance and cleaning
- Amortization of other machinery (specialized tank in semi-finished products warehouse)
- Taxes

### **2.2.2. Milk pasteurization process**

The milk pasteurization process is mainly responsible for sterilizing the milk and also guarantees its preservation in good condition for a longer period of time, reduces the risk of deterioration and minimizes possible losses that may occur during the production process.

This process consists of the heat treatment of the milk in order to suppress the bacteria it contains, this must be calculated very carefully due to the fact that the infectious agents contained in the milk must be eliminated, while maintaining the maximum quality of the milk (Calidad Pascual, 2018).

The main factors that affect the pasteurization process are time and temperature, for this process the temperature of the milk must reach between 55 and 75 degrees Celsius for 17 seconds, only in these conditions we will get the highest quality by eliminating all infectious agents, all these conditions are possible thanks to the specialized tanks where the whole process is fully automated.

The pasteurization treatment of milk eliminates bacteria such as brucellosis, tuberculosis, typhoid, Q fever, salmonellosis, scarlet fever, staphylococcus, coxiella burneti, but while respecting much of its natural flora, this can quickly alter the properties of the milk so it should be kept refrigerated until it reaches the final consumer.

The nutritional properties of the milk during the pasteurization process are practically unchanged, with the exception of vitamins A and B2, which are sensitive to light and are usually lost during the transport process. However, it is thanks to this process that we ensure that the milk reaches our customers' homes with the highest quality.

Once the pasteurized milk is obtained, it is stored in the same specialized tanks and kept waiting to be used in the next process. At this point the milk follows three different phases: it is bottled for subsequent sale to the public, the milk fermentation process is carried out to obtain yogurts of excellent quality and on the other hand, it is distributed to the rest of the departments that although we will not focus on them in this study, it is necessary to record all the processes that are followed in the company that we are analyzing.

#### **Figure 6: Pasteurization Tanks**



*Source: Own elaboration*

These tanks that we can see in the image are responsible for carrying out the whole pasteurization process, these have a small screen where they are programmed temperature and time to keep the milk, and after this time the milk remains in the tank waiting to follow the production process that corresponds.

In this section, we can find the following production costs, among others:

- Semi-finished products costs (raw milk)
- Amortization of specialized machinery (pasteurization tanks)
- Supplies (electricity)
- Taxes
- Cleaning and maintenance
- Indirect labor (supervisor)

### **2.2.2.1. Milk bottling**

The production phase of milk bottling is not a very complex process, on the contrary, it is a very simple process. Once the pasteurized milk has been obtained, a machine specialized in bottling collects the pasteurized milk from the specialized tanks and, by means of a hose that joins them, introduces it directly into previously sterilized plastic bottles. Then, it introduces its respective labeling and cap. Before bottling, the milk must be slowly cooled in order to be introduced into the chambers and, at this very moment, the cold chain must not be lost in order to increase the freshness of the milk.

**Figure 7: Bottling machine**



*Source: Image extracted from a video of the Apunt program.*

In the image we can see how the bottling machine transports the bottles by a small belt four by four and introduces the pasteurized milk, then, although it cannot be seen in the image, this same machine introduces the respective cap and labeling.

They are then collected and grouped by the employees and stored in the refrigeration chambers, waiting to be delivered to their points of sale.

In this section, we can find the following production costs, among others:

- Semi-finished products costs (pasteurized milk)
- Amortization of specialized machinery (bottling machine)
- Bottle and label costs
- Indirect labor (supervisors)
- Supplies (electricity)
- Maintenance and cleaning
- Taxes

#### **2.2.2.2. Milk fermentation process**

The fermentation phase of the milk begins with an intermediate cooling procedure with the objective that the product has an adequate temperature when adding the corresponding ferments, this first process takes place in a specialized machine called yogurt maker, in which, as can be seen in the image, by means of its sanitary techniques, the temperature is reduced to 40-45°C. In it the previously pasteurized milk is deposited and some ferments or bacteria are added to the milk imperceptible to the naked eye, these are live microorganisms with the necessary capacity to transform the milk into yogurt, during this process the bacteria multiply slowly by more than 100 times. These ferments are also responsible for providing the texture of yogurt, in addition to favoring the digestion of lactose and serving as natural preservatives of milk (Spanish Association of Yogurt Manufacturers, 2022).



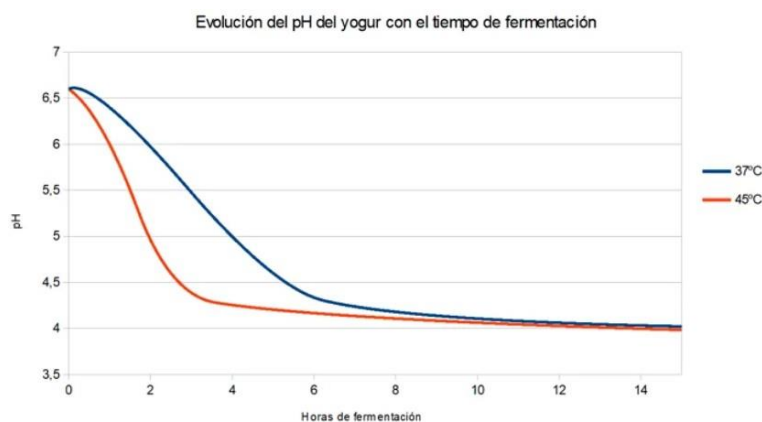
### Image 8: Yogurt maker



Source: Own elaboration

In order to carry out this phase correctly, special attention must be paid to the fermentation time and temperature, which have a direct impact on the quality of the yogurt. We can distinguish 3 different temperatures. Firstly, below 30°C we will obtain a slow fermentation that will last more than 24 hours because the bacteria are not fully active at that temperature. Secondly, with temperatures above 50°C we will not obtain a correct fermentation because the bacteria in charge of fermentation start to inactivate and even die. Thirdly and lastly, with a temperature between 37°C and 45°C, an ideal fermentation is obtained, that is to say, with the highest possible quality, this fermentation can take between 2 and 6 hours.

### Graph 2: Yogurt pH evolution



Source: Graph extracted from the website of El Petinegro (2018).

To establish that the fermentation of the milk has reached its final part of the process, we are guided by the pH, so that it must reach levels below 4.6 to conclude the fermentation process, in addition, as we can see in the graph, the higher the temperature used in the fermentation, the shorter the time used in the process. This milk fermentation process, once the necessary bacteria have been introduced, is carried out in a specialized chamber in which the desired temperature is maintained stable and the milk remains in its final containers, at which point it becomes yogurt.

Once the yogurts have reached the required pH, they are transported to the cold room where they are kept at a temperature of 2° C to 5° C and the cold chain must be maintained until they reach the final consumer.

In this section, we can find the following production costs, among others:

- Semi-finished products costs (pasteurized milk)
- PM Costs (Bacteria)
- Cost RW (Sugar and flavorings)
- Direct labor (1 worker)
- Indirect labor (Supervisors)
- Yogurt maker amortization
- Amortization Fermentation chamber
- Amortization of refrigerated chamber
- Cost of RW (packaging and labels)
- Supplies (electricity)
- Maintenance and cleaning
- Taxes

### **2.2.2.3. Other manufacturing departments**

In this department we will group the manufacturing costs related to other departments that, although in this study we will not focus, mainly for not making a study of such complexity, but that do have importance in the day to day production of the company Lácteos Els Masetes. In addition, the costs that have provided us belong to the whole company, so that the part of the costs that do not correspond to the production of bottled milk or yogurts will be grouped in this department.

The costs to be included in this department will mainly pertain to curds and cheeses, but also to desserts such as cheesecake, cottage cheese, cottage cheese flan and the rest of the costs corresponding to the manufacture of the wide range of products they have.

### **2.3. Cleaning department**

The cleaning department is one of the most undervalued, but it is a vitally important part of production, and more specifically in this company, because Lacteos els Masets offers the highest quality hygiene. Although the sheep themselves are in a very dirty place, the workers who perform this function make sure that, throughout the whole milk exploitation, the whole environment and the milk itself is kept totally disinfected.

In this section, we can find the following production costs, among others:

- Raw Materials costs (Mop, legi, etc...)
- Direct labor (3 workers)
- As it does not occupy a physical space, it is not taxed.

### **2.4. Supervision and maintenance service department**

The supervision and maintenance department is made up of two workers who are not directly in charge of the production process but are nevertheless of great importance to the company as a whole, the manager and the manufacturing supervisor. In addition to supervising that the rest of the workers carry out their part of the corresponding process, they are also in charge of checking that all the machinery works correctly and, if not, finding a solution as quickly as possible so that the factory's production does not stop, or if it does, that it stops for the shortest possible time.

In this section, we can find the following production costs, among others:

- Direct Labor (2 workers)
- Amortization (miscellaneous tools)
- As it does not occupy a physical space, it is not taxed.

## **2.5. Accounting and sales department**

The accounting and sales department is in charge of contacting the different customers, organizing the orders to the deliverymen, as well as accounting for all the invoices whether they correspond to the customer or supplier side, because as it is not an excessively large company, a single worker is capable of accounting for all of them. In the future, if the company continues to expand its customers and, therefore, its sales, it should consider incorporating another worker to this department, and one of them should be in charge of the customer section and the other of the supplier section.

## **3. Implementation of a costing system**

The implementation of a cost system in a company is the set of procedures or technical and administrative methods that companies implement in situations where they want to have greater control of costs, differentiating the costs of each part of the process, so that the entrepreneur can see where most of the costs are accumulated and seek a solution to remedy it, as for example a possible measure would be to abandon a product line because it does not bring any benefit.

All the costs that can be seen below have been obtained after a personal interview with the person in charge of the accounting and sales department. In the interview she was able to provide me with some of the invoices which was a more reliable data or some others she listed the estimated data, anyway, it is enough to give me an idea of the estimated cost which is what I am interested in to be able to make the analysis correctly.

In addition, these costs will be unified all to a short period of time of one month, because many invoices and costs of which I was given information in the personal interview have a duration of one month, therefore, in order not to estimate these costs for a year or a different period of time, we will perform the analysis of the cost system for a single month. This period of time is also easily extrapolated to a year in case we have to compare with a competitor company.

### **3.1. Distribution of material costs to the different departments.**

The first step to begin the analysis of a company's cost system is to detect the material costs, which can be direct or indirect:

Direct Material (DM) costs are those that are used directly for the final manufacture of the product, for example, in the case of the manufacture of T-shirts, the fabric and buttons are DM.

Indirect Materials (IM) costs are those which, due to their special characteristics in the production process, it is not possible to quantify the consumption per unit produced.

In the company we are analyzing the main direct material costs, as we can see in the table, are found in the extraction department because this is the department where the production process begins, that is, where the raw material begins to be transformed, the other costs are of some departments that, for their part of the process, need to introduce other raw materials such as: the packaging of yogurt, the ferments used in fermentation, the sugars and aromas used to give sweeten the yogurt, the bottle for bottling milk, etc. Due to the special characteristics of this production process, we did not find any indirect material costs, so this slightly simplifies the analysis of the company's costs.

<b>Table 1. Distribution of the cost of materials to the different departments</b>							
<b>Material Cost</b>	<b>Extraction</b>	<b>Pasteurization</b>	<b>Traffic jam</b>	<b>Fermentation and packaging</b>	<b>Cleaning and Maintenance</b>	<b>Indirect</b>	<b>Total</b>
Sheep feed (fodder, straw, alfalfa)	4.700,00 €						4.700,00 €
Bacteria				240,00 €			240,00 €
Milk bottles and label			220,00 €				220,00 €
Yogurt packaging and labeling				770,00 €			770,00 €
Sugar, flavorings and preservatives				245,00 €			245,00 €
Cleaning material					100,00 €		100,00 €
<b>Total</b>	<b>4.700,00 €</b>		<b>220,00 €</b>	<b>1.255,00 €</b>	<b>100,00 €</b>		<b>6.275,00 €</b>

### **3.2. Distribution of labor costs to the different departments.**

Labor refers to the effort made by workers in the manufacturing process, both physical and mental, therefore, it requires that this be remunerated. All the labor that works for a company is divided into two parts, as indicated in Professor Alcarria's cost manual (Alcarria, 2020), direct and indirect labor:

The direct labor force (DL) are all those workers who receive a monthly remuneration and work directly in a part of the transformation process of the raw material, even if there are some parts of the process that are fully mechanized, without the direct labor force it would not be possible to carry out the transformation process.

Indirect labor (IL) are those paid workers who provide supervision to the direct labor force or perform support tasks to the rest of the workers, but they do not work directly in the manufacturing process. They perform management or commercial management tasks.

In the company we are analyzing there are a total of 16 paid workers which are all DL except for 2 of them who are IL, as we can see in the table, they are the manager and the person in charge of manufacturing supervision. The cost of these two workers will be applied to the rest of the departments later. The cost of the rest of the workers is applied to the department where they carry out their part of the production process, in each department the workers have the same cost, except in the extraction department, where one worker, due to working hours, has a cost of 1,700€ and the other two of 1,500€, a total of 4,700€, as shown in the table.

Workers working in the same departments all have the same cost to the company, and the table shows the total labor cost per department.

<b>Table 2. Distribution of labor costs to the different departments.</b>							
<b>Labor cost</b>	<b>Extraction</b>	<b>Pasteur.</b>	<b>Traffic jam</b>	<b>Fermentation and packaging</b>	<b>Cleaning and Maintenance</b>	<b>Indirect</b>	<b>Total</b>
3 Milkers	4.700,00 €						4.700,00 €
3 Cleaning					3.300,00 €		3.300,00 €
1 Manufacturing Supervisor						1.500,00 €	1.500,00 €
1 Manager Supervisor						2.800,00 €	2.800,00 €
1 Fermentation workers				1.300,00 €			1.300,00 €
<b>Total</b>	<b>4.700,00 €</b>	<b>- €</b>	<b>- €</b>	<b>1.300,00 €</b>	<b>3.300,00 €</b>	<b>4.300,00 €</b>	<b>13.600,00 €</b>



### 3.3. Distribution of other costs to the different departments.

In this process we will distribute the rest of the costs such as depreciation, supplies or taxes to the different manufacturing departments. First, we will list the depreciations, with their costs, residual value and useful life. The depreciation period has been established using two sources of information: From the AEAT (Agencia Estatal de Administración Tributaria) from the simplified depreciation tables and from the BOE (Official State Gazette), Order HAC/1155/2020. Since the rest of the costs are represented in months, the useful life indicated in the table is also represented in months.

<b>Table 3. Monthly amortizations</b>				
	Acquisition price	residual value	useful life (months)	Monthly amortization
Amortization Sheep	80.000,00 €	0,00 €		833,33 €
Amortization Farm	350.000,00 €	150.000,00 €	240	833,33 €
Amortization Milking machine	40.000,00 €	5.000,00 €	216	162,04 €
Amortization Raw milk tank	5.400,00 €	540,00 €	240	20,25 €
Amortization Pasteurization tank	21.300,00 €	2.130,00 €	240	79,88 €
Amortization Bottling machine	30.000,00 €	3.000,00 €	216	125,00 €
Amortization Yogurt Maker	15.000,00 €	1.500,00 €	216	62,50 €
Amortization Fermentation chamber	3.500,00 €	0,00 €		24,31 €
Amortization Refrigeration chamber	6.000,00 €	0,00 €		41,67 €
Depreciation Furniture	3.000,00 €	300,00 €	240	11,25 €
Depreciation Other fixed assets(maintenance)	4.000,00 €	400,00 €		60,00 €

In this section of the cost analysis I have selected all the goods involved in the production process, and then I have consulted with the company which were the cost prices, residual value, useful life, date of purchase. This last one, to check if there was any asset that was already fully depreciated, but as it is a relatively new company there is no asset that is already fully depreciated.

<b>Table 4. Distribution of other costs to the different departments.</b>							
<b>Other Costs</b>	<b>Extraction</b>	<b>Pasteurization</b>	<b>Traffic jam</b>	<b>Fermentation and packaging</b>	<b>Cleaning and Maintenance</b>	<b>Indirect</b>	<b>Total</b>
Amort. Sheep	833,33 €						833,33 €
Amort. Farm	833,33 €						833,33 €
Amort. Milking machine	162,04 €						162,04 €
Amort. Raw milk tank	20,25 €						20,25 €
Quality control						350,00 €	350,00 €
Veterinary	400,00 €						400,00 €
Amort. Pasteurization tank		79,88 €					79,88 €
Amort. Bottling machine			125,00 €				125,00 €
Amort. Yogurt Maker				62,50 €			62,50 €
Amort. Fermentation chamber				24,31 €			24,31 €
Amort. Refrigeration chamber				41,67 €			41,67 €
Amort. Furniture						11,25 €	11,25 €
Amort. Other fixed assets (maintenance)					60 €		60 €
Supplies (electricity)						2.800,00 €	2.800,00 €
Supplies (water)						215,00 €	215,00 €
Taxes (IBI)						250,00 €	250,00 €
Taxes (Garbage Tax)						25,00 €	25,00 €
<b>Total</b>	<b>2.248,95 €</b>	<b>79,88 €</b>	<b>125,00 €</b>	<b>128,47 €</b>	<b>60 €</b>	<b>3.651,25 €</b>	<b>6.293,55 €</b>

In the case of sheep, the cost of 80,000 euros is due to the fact that the farm currently has 800 sheep valued at around 100 euros each, which they buy when they are lambs and feed them themselves because this way it is more cost effective.

In the depreciation of furniture we have represented shelves, tables and other furniture used throughout the factory, therefore its cost has been applied as indirect to later distribute it in the primary distribution of the CIF.

Then, all the depreciation costs listed above must be applied to their corresponding department. In this table we must also add some other costs of the period that, although they are not amortizable, are applicable, such as: veterinary costs, a quality control that is carried out monthly, water and electricity supplies, and the different taxes that correspond to them, the latter two being indirect costs, as indicated in the table. These indirect costs will be distributed to the rest of the departments later in the primary distribution of indirect manufacturing costs.

### 3.4. Primary allocation of production overhead costs

Prior to the primary allocation of the indirect manufacturing costs (all those that have previously appeared in the indirect costs column in blue) we must decide which would be the best option to allocate these costs correctly, although there is no exact rule for this and it will always be up to the choice of the person performing the analysis.

As for the allocation bases, there are an infinite number of possibilities because as I said before this decision is the choice of the person performing the analysis, but the most frequent are: according to the square meters used in manufacturing, according to the cost of the DL (usually used for the IL), according to the direct material costs (usually used for the MI costs), according to the units produced that are used in the manufacturing departments, according to the hours employed, among others.

<b>Table 5. Primary allocation bases</b>		
CIF group 1	according to m2 used	Taxes and utilities (water and electricity)
CIF group 2	according to Liters of pasteurized milk used in manufacturing dpt.	IL, Quality Control

Throughout this analysis we have detected four different indirect costs, which we will distribute by grouping them into two groups of indirect costs, because we will apply two different allocation bases, according to the square meters used in production and

according to the liters of pasteurized milk used in the different departments, and in the event that some costs coincide in the same allocation base, we will group them in a more structured way. As shown in Table 5.

The reason for the allocation of the taxes and supplies according to square meters is due to the fact that the taxes are paid with respect to the land that you have available whether it is a house or a factory, that is to say, the squarer meters of surface you have, the more IBI tax you will pay, and the more surface you have, the more garbage you are supposed to generate, therefore, you will also pay more. We will apply the cost with respect to the useful surface of each apartment using the floor plan of the factory. Similarly, supplies are a cost that is used in all manufacturing departments, but the larger the department the lighter it will spend, so we will apply this allocation base for the cost distribution.

The IL must also be distributed to the rest of the departments through an allocation basis, if we review where this cost comes from we observe that it is from the salary of the manager and the manufacturing supervisor, they review the totality of the departments, although allocating the cost with respect to the square meters, another even better option is to allocate it with respect to the liters of pasteurized milk produced due to the fact that this way we focus more the cost in the last manufacturing departments which is where their daily function of help and supervision to the workers is more centered.

This is due to the fact that milk is a very delicate product with a very short shelf life. For this reason, the most appropriate basis for allocating the cost is the liters of pasteurized milk, i.e., we will include it in group 2, as shown in the table.

<b>Table 6. Criteria and basis of allocation</b>								
<b>Basis of allocation</b>	<b>Extraction</b>	<b>Pasteur.</b>	<b>Traffic jam</b>	<b>Fermentation and packaging</b>	<b>Other dpt.fab.</b>	<b>Cleaning and Maintenance</b>	<b>Admin. sales</b>	<b>Total</b>
m2 (%of total)	0,21	0,07	0,06	0,06	0,54	0	0,06	<b>1</b>
liters of pasteurized milk used	0	0	1782	5346	10692	0	0	<b>17820</b>

Subsequently, we must establish the criteria and bases of distribution necessary to be able to distribute the indirect costs, as for the square meters of the factory we will extract them from the factory plan calculating approximately the percentage that each department represents with respect to the useful meters for the manufacture, that is to say, the total meters except for the bathrooms and the corridors.

The liters of pasteurized milk will be calculated based on the total milk produced in a month because we will assume that during the extraction and pasteurization process we have no losses. After consulting with the company I was told that currently of the 800 ewes they have only 330 are being milked twice a day, the rest of the ewes are not being milked because they are still lambs, pregnant or in the process of being pregnant. Each one of them produces around 1.8 liters of milk per day, obtaining 594 liters of milk per day, therefore, we obtain that throughout one month they have produced 17,820 liters of milk.

<b>Table 7. CIF primary distribution</b>								
<b>Other Costs</b>	<b>Extraction</b>	<b>Pasteur.</b>	<b>Traffic jam</b>	<b>Fermentation and packaging</b>	<b>Other fab. dpt.</b>	<b>Cleaning and Maintenance</b>	<b>Admin. and sales</b>	<b>Total</b>
CIF Group 1 (taxes and supplies, depreciation of furniture)	693,26 €	231,09 €	198,08 €	198,08 €	1.782,68 €	- €	198,08 €	3.301,25 €
CIF Group 2 (IL, quality control)	- €	- €	465,00 €	1.395,00 €	2.790,00 €	- €	- €	4.650,00 €
<b>Total CIF primary distribution</b>	<b>693,26 €</b>	<b>231,09 €</b>	<b>663,08 €</b>	<b>1.593,08 €</b>	<b>4.572,68 €</b>	<b>- €</b>	<b>198,08 €</b>	<b>7.951,25 €</b>

Finally, we will distribute the cost depending on the corresponding allocation base, in the case of supplies and taxes we will distribute the cost of €3,301.25 that we can see in table 4 by multiplying it by the percentage of m<sup>2</sup> occupied by each department that we can see in table 6. And, in the case of IL costs we will distribute the cost of 4,650€, which we can find in table 2, regarding the percentage of liters used in the department, this must be calculated by dividing the liters used in the department to be calculated and the total liters of pasteurized milk.

### **3.5. Secondary allocation of production overheads**

The secondary distribution or cost overrun consists of distributing the primary costs of the secondary sections (cleaning and maintenance departments) to the rest of the departments to which they provided services. This phase is triggered by the existence of secondary sections in which there is no direct connection with the actual production and sales of the year, making it very difficult to allocate the costs to the production of the period, except by means of the sections.

The most optimal way to perform the secondary apportionment is to use the services rendered by the secondary section to each of the sections for which it has worked as a basis for apportionment.

As we can see in the table, the cleaning and maintenance department is the secondary section that we will have to distribute to the departments it serves, that is, all the other departments. The way we will use to distribute the cost will be with respect to the square meters because the larger the department the more time it will cost to clean and perform the corresponding maintenance. The operation to calculate to allocate the cost will be to divide the square meters of the department to be calculated by the total square meters minus the cleaning meters, and multiplying all this by the cost of the cleaning department to be distributed.

Once the cost of the cleaning department has been distributed to the rest of the departments, we will add the primary distribution and thus obtain the secondary distribution of the indirect manufacturing costs.



<b>Table 8. CIF secondary distribution</b>								
<b>Other Costs</b>	<b>Extraction</b>	<b>Pasteur.</b>	<b>Traffic jam</b>	<b>Fermentation and packaging</b>	<b>Other fab. dpt.</b>	<b>Cleaning and Maintenance</b>	<b>Admin. and sales</b>	<b>Total</b>
CIF primary distribution	693,26 €	231,09 €	663,08 €	1.593,08 €	4.572,68 €		198,08 €	7.951,25 €
DL for cleaning and maintenance						3.300 €		3.300,00 €
MD cleaning and maintenance						100 €		100 €
Other cleaning and maintenance costs						60 €		60 €
Total primary CIF, including MD and DL and others from service departments	693,26 €	231,09 €	663,08 €	1.593,08 €	4.572,68 €	3.460,00 €	198,08 €	11.411,25 €
Cleaning distribution (according to m2)	726,60 €	242,20 €	207,60 €	207,60 €	1.868,40 €	- 3.460,00 €	207,60 €	- €
<b>Total CIF Secondary Distribution</b>	<b>1.419,86 €</b>	<b>473,29 €</b>	<b>870,68 €</b>	<b>1.800,68 €</b>	<b>6.441,08 €</b>	<b>- €</b>	<b>405,68 €</b>	<b>11.411,25 €</b>

### 3.6. Total costs by department

After carrying out all the above procedures and, once the costs have been detected and distributed correctly, we will prepare a table to have all the costs better organized to facilitate the following procedure.

In this table we can see that the department with the lowest cost is the pasteurization department with a little more than 500€ per month, however, the most expensive is the extraction department, which is 20 times more expensive.

<b>Table 9. Total costs by department</b>							
<b>Other Costs</b>	<b>Extraction</b>	<b>Pasteurization</b>	<b>Traffic jam</b>	<b>Fermentation and packaging</b>	<b>Other fab. dpt.</b>	<b>Administration and sales</b>	<b>Total</b>
Direct materials	4.700,00 €		220,00 €	1.255,00 €			6.175,00 €
Direct labor	4.700,00 €			1.300,00 €			6.000,00 €
VAT ID	1.419,86 €	473,29 €	870,68 €	1.800,68 €	6.441,08 €	405,68 €	11.411,25 €
Other direct costs	2.248,95 €	79,88 €	125,00 €	128,47 €			2.582,30 €
<b>Total department costs</b>	<b>13.068,82 €</b>	<b>553,16 €</b>	<b>1.215,68 €</b>	<b>4.484,15 €</b>	<b>6.441,08 €</b>	<b>405,68 €</b>	<b>26.168,55 €</b>

### 3.7. Costs incurred in the various departments and warehouses

In this section, we will gather the above mentioned costs grouping them in the different departments and accumulating the costs following the order indicated in the flow chart 2, with the objective that at the end of the process we can visualize most of the costs and know which is the unit cost of each product, both semi-finished products and final products.

#### 3.7.1. Extraction Dept.

The process of making bottled milk and yogurt begins with the extraction of the raw material from the sheep themselves.

##### DF Extraction

MD	4.700,00 €	Finished production (24000 liters)	13.068,82 €
DL	4.700,00 €	Production in progress	- €
VAT ID	1.419,86 €		
Other direct costs	2.248,95 €		
<b>Total</b>	<b>13.068,82 €</b>	<b>Total</b>	<b>13.068,82 €</b>

In order to calculate the unit cost of raw milk, we must include all the costs that have been incurred up to the moment it is extracted from the sheep. These costs are the 4,700€ of direct materials from the sheep feed, the 4,700€ of direct labor costs corresponding to the three workers who take care of the sheep and extract the milk, we must also add the costs from the secondary distribution (1,419.86€) and other direct costs (2,248.95€) from the different amortizations that we can see in table 4.

All these costs have a total cost of 13,068.82€, being equal to the finished production because there is no production in progress, therefore, if we divide the finished production by the liters of milk extracted monthly (17,820 liters), we obtain a unit cost of raw milk of 0.73379€/liter.

### 3.7.2. Semi-finished products warehouse, raw milk

After extraction, the raw milk is stored in cold storage tanks.

Warehouse semi-finished products Raw milk			
Tickets	13.068,82 €	Exits	13.068,82 €
Initial stock	- €	Final inventories	- €
<b>Total</b>	<b>13.068,82 €</b>	<b>Total</b>	<b>13.068,82 €</b>

In these milk tanks, milk is stored for a short period of time. In this warehouse it is assumed that prior to the study there was no initial stock nor is there any stock left in the tank, for simplicity of calculation, all the liters of milk that enter are distributed to the different departments without anything remaining pending in any warehouse. Therefore, the inputs are equal to the outputs, €13,068.82, which will enter as Semi Finished Products (STP) to the next department.

### 3.7.3. Pasteurization Dept.

If we continue with the production organization chart, after the extraction and storage we find the pasteurization department.

DF Pasteurization			
Costs semi-finished products	13.068,82 €	Finished production	13.621,98 €
MD	- €	Production in progress	- €
DL	- €		
VAT ID	473,29 €		
Other direct costs	79,88 €		
<b>Total</b>	<b>13.621,98 €</b>	<b>Total</b>	<b>13.621,98 €</b>

In it we must accumulate the costs of the semi-finished products (13,068.82€) coming from the previous semi-finished products warehouse, plus the indirect manufacturing costs that we have extracted from the secondary distribution (473.29€), plus other direct costs coming from the amortization of the pasteurization tank (79.88€). Since no additional raw material is added to this department, nor does any worker work directly, we have neither MD costs nor DL costs. Obtaining a total cost of the pasteurization department of 13.621,98€, being this the same the finished production of pasteurized

milk, because for simplicity reasons we do not have production in process.

Furthermore, if we take into account that they obtain 17,820 liters of milk per month, extracted from the 330 ewes that are currently producing milk, we can conclude that the unit cost of pasteurized milk is 0.7644€/liter.

### 3.7.3.1. Bottling Dept.

After the pasteurized milk store, the production process is divided into two different paths: On the one hand, one part of the milk is taken to bottling (this is the process we are going to analyze now) and the other to fermenting to produce yogurts.

The pasteurized milk passes through a machine that is in charge of the whole bottling process.

#### DF Milk bottling

Previous costs	1.362,20 €	Finished production	2.577,87 €
MD	220,00 €	Production in progress	- €
DL	- €		
VAT ID	870,68 €		
Other direct costs	125,00 €		
<b>Total</b>	<b>2.577,87 €</b>	<b>Total</b>	<b>2.577,87 €</b>

In this department we find costs of the previous departments, but only the costs of 1,782 liters of milk that are destined to this department, being this cost (1,362.20€) obtained by multiplying the liters of milk destined by the unit price of pasteurized milk that we have obtained in the previous section (0.73€/liter). Also corresponding to this department are the direct material costs corresponding to the milk bottles (220€), the costs obtained from the secondary distribution corresponding to other indirect costs (870.68€) and other direct costs from the depreciation of the bottling machine (125€). In this department, since no worker works directly, the direct labor cost is 0, obtaining a total cost of the milk bottling department of 2,577.87€.

As we have no production in progress, this cost will be equal to the finished production, thus obtaining a unit cost per bottle of milk of 1.4466€/bottle, due to the fact that the bottles are of 1 liter of milk.

### 3.7.3.2. Bottled milk warehouse

The last process to be carried out with respect to the already bottled milk bottles is to store them until the delivery drivers take them away to distribute them to the customers.

#### Bottled Milk Warehouse

Tickets	2.577,87 €	Exits	- €
Initial stock	- €	Final inventories	2.577,87 €
<b>Total</b>	<b>2.577,87 €</b>	<b>Total</b>	<b>2.577,87 €</b>

The inputs to this warehouse are those corresponding to the outputs of the bottling department (€2,557.87), and it is assumed that prior to the study there was no initial stock and no stock remains in the tank, for simplicity of calculation. Therefore, we obtain that the inflows are equal to the ending stocks because we will assume that the stocks are not yet sold and are kept in the warehouse.

### 3.7.3.3. Fermentation and packaging department

The other part of the pasteurized milk leaving the pasteurized milk department is processed in the fermentation and packaging department to become high quality yogurts.

#### DF fermentation and packaging

Previous costs	4.086,59 €	Finished production	8.570,74 €
MD	1.255,00 €	Production in progress	- €
DL	1.300,00 €		
VAT ID	1.800,68 €		
Other direct costs	128,47 €		
<b>Total</b>	<b>8.570,74 €</b>	<b>Total</b>	<b>8.570,74 €</b>

In this manufacturing department there are costs from the pasteurization department, but, as this department only receives a total of 5,346 liters of milk corresponding to 30% of the total pasteurized milk, if we multiply this milk by the unit cost we obtain a cost of €4,086.59, there are also direct material costs from the ferments, yogurt containers, sugar and flavoring used in the process (€1,255).255), as can be seen in table 1, direct labor costs of 1 worker (1.300€), the indirect cost coming from the secondary distribution of the cleaning and maintenance department (1.800,68€), and other direct costs

corresponding to the amortization of the machinery used in the process (128.47€) as can be seen in table 4.

As we have no production in progress, this cost will be equal to the finished production, thus obtaining a unit cost per liter of fermented milk of 1.6032€/liter, but as the yogurts are in 125ml containers and in packs of 2 yogurts, we obtain a cost per pack of two yogurts (250ml) of 0.40€/pack.

### 3.7.3.4. Yogurt warehouse

The final process that takes place in the yogurt process is its final storage where it will be kept waiting to be transported by the deliverymen to the customers.

#### Yogurt warehouse

Tickets	8.570,74 €	Exits	- €
Initial stock	- €	Final inventories	8.570,74 €
<b>Total</b>	<b>8.570,74 €</b>	<b>Total</b>	<b>8.570,74 €</b>

The inputs to this warehouse are those corresponding to the outputs of the fermentation and packaging department (€8,570.74), and it is assumed that prior to the study there was no initial stock nor is there any stock left in the tank, for simplicity of calculation. Therefore, we obtain that the inflows are equal to the ending stocks because we will assume that the stocks are not yet sold and are kept in the warehouse.

### 3.8. Cost check

<b>Costs incurred</b>	<b>Total</b>	<b>Distributed costs</b>	<b>Total</b>
Total cost of materials	6.275,00 €	PT bottled milk	2.577,87 €
Total labor cost	13.600,00 €	PT yogurt	8.570,74 €
Total other costs	6.293,55 €	Costs assigned to other manufacturing departments that are not considered in the task.	14.614,26 €
		Costs assigned to administration and sales, which are not considered in the job	405,68 €
<b>Total cost incurred</b>	<b>26.168,55 €</b>	<b>Total allocated cost</b>	<b>26.168,55 €</b>

In this last section of the study we will focus on verifying that we have included all costs on both sides of the study, both incurred and distributed costs.

As we can see in this check table, after including in the costs incurred the costs of materials, labor costs and the total of other costs, we obtain a total of 26,168.55€. In the same way, if we add the costs distributed to the different departments, that is, the finished products of bottled milk, the finished products of yogurts, the costs that we have assigned to "other departments" that correspond to the production processes of curds, cheeses, etc... that although in this study we have not focused we must include because the company does assume these costs, and the costs of the administration and sales department that do not correspond to a higher cost of the products. With this sum we also obtain the same cost as with the costs incurred, i.e., we have not forgotten any cost and we can affirm that the study has been carried out correctly.



#### **4. Conclusion**

In this last part of the study we will compare which are the parts of the production process with more costs and thus seek some way to minimize costs, or even if it were the case that a product line was not profitable for the company, abandon that product line and thus focus on producing the truly beneficial for the company. All this with the aim of increasing the profit margin of the company without having to give up the loss of any of the customers.

As we can see in point 3.6. where the total costs of each department are reflected, we detect that the department with the highest costs is the extraction department, this is produced for several reasons, for being one of the departments with more employees, because the sheep must be milked every day, whether weekends or holidays, and therefore requires a greater number of workers to be in charge of performing this task, while the factory only produces five days a week, not including holidays. In addition, the sheep must be fed every day of the week, which makes it the most expensive department.

One possible measure that could be implemented in this department for higher productivity and, therefore, lower worker hours, is the purchase of a milking machine with a higher capacity of ewes.

Another of the most costly departments for the company is the fermentation department, because it is a process that requires several procedures and, because of this, the performance of a greater amount of machinery and specialized chambers. And there is only one worker, so it is difficult to reduce costs in this department. One measure that could be taken to try to reduce costs slightly would be to renegotiate the price of the raw materials that are introduced in this department with the corresponding supplier, thus obtaining a greater profit margin.

As a final conclusion we obtain that the company Lacteos Els Masets has quite optimized costs as we have observed in the study, with which we recognize its exponential increase in the dairy market in recent years.

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