



# POLITECNICO DI TORINO

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# ABSTRACT

In the following monography the productive process of Ferrero Company was analyzed by focusing on the fabrication of Nutella, an spreadable cream recognized by the world because of its color, fragrant, texture and characteristic flavor. During the investigation, problems and difficulties were identified in the different stages of the productive process, which are principally focused on environmental impact, where the needs to be intervened were categorized and classified.

Once the enterprise analysis was made some waste with great potential were discovered as they can be transformed and reused directly in the company with the intervention of a design process to give them a new objective, thus closing internal cycles that for the moment did not have any systemic output. Besides closing the cycle, this new product pretends to be a tool for the company to make a bridge between them and the clients, reinforcing and improving the perceived image of Nutella, their main values (which had been put aside in many cases) and demonstrate the interest of Ferrero in being a sustainable and integral company.

Key words: Bagasse, packaging, systemic process, output, input, single-use packaging, waste, perceived value, added value.

# RESUMEN

En el trabajo a continuación se analizó el proceso productivo de la compañía Ferrero enfocándose en la elaboración de Nutella, una crema esparcible reconocida a nivel mundial por su color, aroma, textura y característico sabor. En la investigación se identificaron problemas y dificultades que se presentaban en las diferentes etapas del proceso, enfocadas principalmente en temas de impacto ambiental, donde se categorizaron y clasificaron las necesidades a intervenir.

Una vez hecho el análisis de la empresa se descubrieron algunos residuos con gran potencial que podían ser transformados y reusados directamente en la compañía con la intervención de un proceso de diseño para darles un nuevo objetivo, cerrando así ciclos internos que hasta el momento no tenían una salida sistémica.

Aparte del cierre del ciclo, este nuevo producto también tenía como objetivo principal ser una herramienta para que la empresa cree un puente entre ellos y los usuarios, reforzando y mejorando la imagen percibida de Nutella, sus principales valores, que muchas veces son puestos en un segundo plano y demostrar el gran interés de Ferrero por ser una compañía íntegra y sostenible.

Palabras Claves: Bagazo, packaging, proceso sistémico, output, input, empaques de un solo uso, residuos, valor percibido, valor agregado.

*"Everything is design, and the design quality affects the quality of our live"*

**-Norman Foster**

# ACKNOWLEDGMENTS

Quiero agradecerle a mi madre y a mi padre por el gran esfuerzo hecho para darme la oportunidad de estar hoy aquí presentando este documento, también quiero agradecerles por la excelente educación que me han brindado, por todo su apoyo y amor incondicional, lo cual me ha impulsado para ir más allá de los límites y es por eso quiero dedicarles este documento como muestra de mi amor y agradecimiento.

Por otro lado quiero reconocer el rol que jugaron algunas personas en este pasar de meses apoyándome en los momentos donde no surgían las ideas o no sobraba el tiempo y que hacían más llevaderos de los momentos de estrés, resaltando a una persona que estuvo ayudándome en la revisión, corrección y traducción de documento como si fuera suyo.

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Por ultimo también quiero dedicarle este documento a mi hermana quien siempre ha sido un impulso para mí, siendo una de mis motivaciones para llegar lo más lejos posible y poder ser un excelente modelo a seguir para ella.

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# INTRODUCTION

## What is Ferrero?

Pietro Ferrero was an Italian pastry chef who in 1940 made the decision to devote himself to the creation of small chocolates with the intention to put within reach of all people desserts and sweets that for the time were seen as exclusive products for special events. Although Pietro tries to demolish this paradigm, his real reason of success is due to the use of a new mixture for the production of chocolate initiated by the cocoa shortage and its high price that leads him to look in the historical archives, where he finds a recipe used in the Napoleonic wars, a technique that used hazelnuts to reduce cocoa consumption. This ingenious solution, plus the great skill of Ferrero in the kitchen, leads him to create a unique product that people will love not only because it was much cheaper than the kilo of chocolate, whose price ranged between about 3000 lira against the 600 lira of the new product, but also for its irresistible aroma and flavor.

This product began to be very popular in Alba the city where the first laboratory took place, but the family wanted to take Gianduja, name that receives the first product of the company, to every corner of Italy and that is why Giovanni Ferrero, Pietro's brother, creates a distribution system and takes 12 cars of the classic Fiat Toppolino and with this begins an effective distribution campaign, leading the company to great growth passing from a production in early 1946 of 300 kilograms to 10,000 kilograms at the end of the same year, which as results in the official birth in front the authorities, the Italian chamber of commerce, of the Ferrero company.

Notwithstanding that Pietro Ferrero and his brother could not enjoy their great success, as they died in 1949 and 1957 respectively, they could leave very well structured the foundations of what Michele Ferrero, son of Pietro, was going to inherit very. This young man receives a company with an excellent product, nationally well know and with its first production factory located abroad, more precisely in Stadthallendorf, Germany.

With Michele in charge, not only the Ferrero's economic boom was born, but also new principles are established in the company, which seeks innovation not only on products but also on their production method. After the great success of his arrival in Germany and his new chocolates, Ferrero sets out to take more ground in the European market and opens a second international production plant located in France, with approximately 700 employees, whose main objective was the creation of snack products. Thus Michele was creating an immense conglomerate of factories around Europe with specific objectives, such as Pozzuolo Martesuna outside Milan or the Avellino center located in southern Italy whose main objective was the processing of hazelnuts.

Already established in Europe in the early 60s Michele seeks to expand more, now relying on the new technologies of the moment and that is why his first publicity spot comes out in television in 1967 starting a new generation where Ferrero will no longer stop its growth.

The worldwide expansion of this renowned company continued in United States followed by Ireland, Austria, Ecuador, Turkey and Japan, among others. This process goes on until we reach what we know today, a company that is established in 55 countries, has production plants in 22 of them and sells in 170 different countries of the planet.

## **What are Ferrero Products?**

Ferrero is born with an innovative chocolate that seeks to reduce the amount of cocoa using hazelnuts to cover the deficit of the aforementioned raw material, reducing production costs that were affected by political issues of the time. This is how Giandot was born, a chocolate paste that was sold wrapped in a sheet of aluminum foil that melted easily on bread. Quickly this unique product handled by Ferrero became a success and went through several name changes such as Cremalba or Supercrema and finally would end up becoming in 1964 in the famous Nutella, the company's Core product.

For Ferrero, the conquest of the spreadable market was not enough, so with the arrival in Germany in 1956 they created Mon Cheri, a chocolate-coated bonbon that hides a cherry in its center. A product that gave the brand great popularity in Europe, helping its growth and giving the green light to the opening of its new production plant, Ferrero France, nowadays the biggest one that Ferrero has.

Ferrero France was built in 1960, the new factory had as its main objective the creation of new products that were focused on the snack time. As a result, in 1961 they create Brioss, Nutella's new challenge to the market for children and young people, consisting of a small piece of cake packed in a single-dose presentation that intended to give a solution to the Mothers of the time that didn't have enough time to prepare them. This product, like Nutella, also went through several names, including Fiesta, until we reach what we currently known as Kinder Delice, a name that demonstrated Nutella's internationality for the moment, using a word that meant child in German.

In the 60s a new trend reaches homes and the parents of the world begin to question about the nutrition of their children. As a good visionary Michele reacts to this need and creates in 1968 the Kinder bars, a chocolate bar with a milk interior sold with the slogan "more milk less cocoa", quickly becoming a success among families. Ferrero, already having the perfect product for children, presents a new problem, the kinder bars were aimed at children, which excluded adults, so at the same time to the Kinder bars, Ferrero launched some small boards of chocolate and coffee, a new concept called Pocket Café

that tried to establish the "Dolce Pausas" a moment to rest and have a boost of energy even when the nearest bar was far.

To cross the Atlantic and settle in the United States of America, Ferrero manages not to arrive empty-handed and creates a product in 1969, something far from what they usually did, consisting of small mint pills that they will call Tic Tacs, these would quickly become renowned, putting Ferrero on the map of America and also opening the doors for his new production plant.

As the company's plan for creating a new product that was not related to the chocolate world came out very well, the company decides it is time to enter to the beverage market and Ferrero welcomes Estathé tea to the family in 1972.

A few years later Michele looks back at what he knows best, chocolates, and realizes that he had already solved the problem of parents' food concerns but that he could still get more profits from that concept. So to try to make Kinder more appealing to children, he created in 1974 Kinder Division, a product that was still backed by the slogan of "more milk less cocoa", but this time when splitting it you could find in the middle, in addition to the two main ingredients of Kinder, a small surprise, a toy with comic characters of the time, causing all children to jump to supermarkets for one of those. This is what we know today as surprise Kinder.

In 1982 Pietro's dream comes true thanks to his son Michele, when he creates Ferrero Rocher, a type of premium chocolate made up of a layer of chocolate, another one of cookie and a heart of hazelnut chocolate paste with a hazelnut inside. Since the birth of the company Pietro had wanted to make high-quality chocolate pieces for its customers that were affordable and it is not until this date that Ferrero collection succeeds and positions itself in the market.

Thus the company continued to grow and as it grew in new locations it also continued to grow in products such as Kinder Cereali in 1975, Kinder Colazione in 1981, Kinder Delice in 1985 and after the cold war with products such as Kinder Bueno and Kinder Pingui and among others.

## **What is Nutella?**

Today Ferrero is an umbrella company, with a series of products that show a clear strategy for creating brands with their own identity and relevance so that each of these sub-brands can develop an image independently without interference from any connotation. Even managing each brand as an independent company, they all succeed equally and as Franco Martino IMC and media strategy management of Ferrero Iberica affirms "all shine with the same intensity"(Martino, F. (n.d.). *Entrevista a Franco Martino*), but still there is one that stands out more than the others, not because it is tastier but because it

is the best-selling product of all brands that the ferrero family has and it is Nutella.

Graph 1



Nutella is a spreadable sweet paste, the result of an ingenious solution to the shortage of cocoa that the world lived at that time, becoming the first product produced by Ferrero in 1946 with the name of Giandujot, a name inspired by a carnival character of the Piemonte region. Later on his Packaging was changed, along with his image and his name to Supercrema but it was not until 1964 that with another change of image and innovation of recipe, proposed by Michele Ferrero, Nutella was born, a cream loved by European palates that in 1965 designed his emblematic packaging, the "Pelikan", giving birth to the legend that until today maintains the same acceptance, popularity and recognition received since its beginning. These are some of his presentations today:

Graph 2



Single dose presentation designed for a single portion of Nutella with a net content of 15g. Polystyrene packaging with an aluminum and plastic cap

Nutella productos. Retrieved from <https://www.ferrero.com.mx/productos/nutella>

Graph 3



Nutella productos. Retrieved from  
<https://www.ferrero.com.mx/productos/nutella>

Presentation of 200g of Nutella, it is the most modern container of the Ferrero brand. He joined the family to give an intermediate dose of Nutella between the existing presentations and to respond to the current environmental needs. Its parts are a glass vase inspired by the subtlety of the Murano glass, a safety lid made of aluminum and finally a polypropylene lid.

Graph 4



Nutella productos. Retrieved from  
<https://www.ferrero.com.mx/productos/nutella>

Traditional presentation of Nutella, it was born in 1965 inspired by the ink packaging of the time, where the supply mouth was wide facilitating the access to the product. This design is made of a central glass container, an aluminum safety lid and a polypropylene lid. It can be found in the presentations of 350g, 450g, 630g, 750g, 825 and 1kg.

Nutella is no longer just a product immersed in a glass jar, it's also a huge social network of 31 million followers on Facebook, 1.6 million followers on Instagram, a world day in its name that is celebrated every February 5th since 2007 and a coffee restaurant that opened in 2017 in the city of Chicago. Nowadays, Nutella's popularity is so immense that not only can it be considered the best-selling product of the Ferrero family but we also have to understand it as the product that has control of the spreadable market with 88% in Italy and 54% in the world, a record that no company has managed to snatch.

# THEORETICAL FRAMEWORK

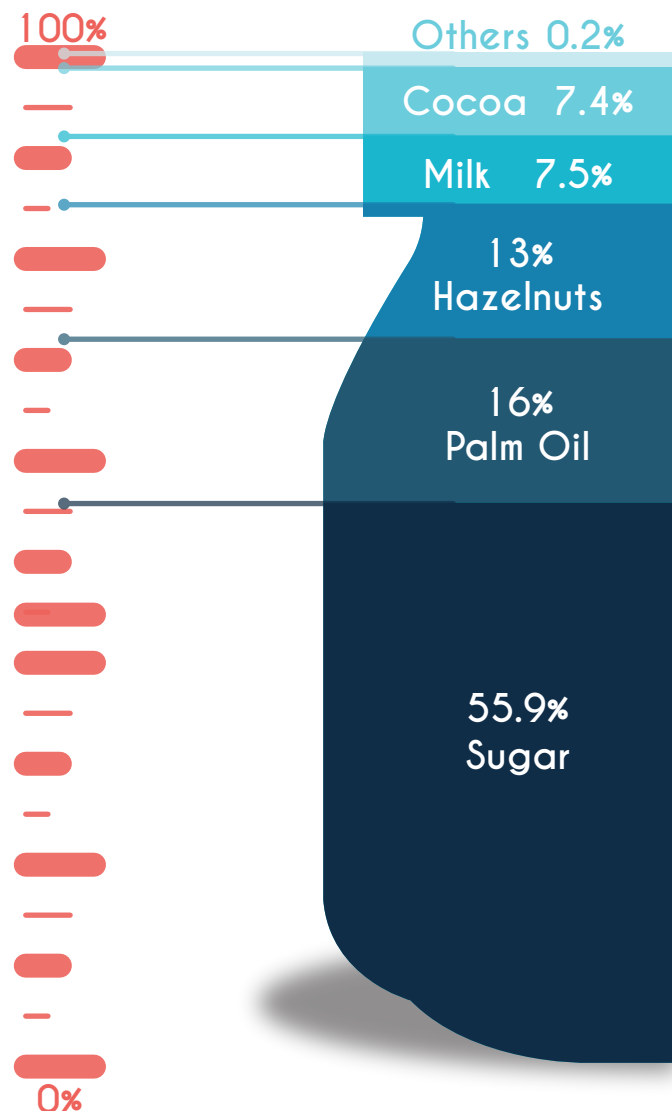
Nutella is a product that is currently been sold all around the world. In order to understand the magnitude of the topic we have to put in numbers the business of Nutella which nowadays, as Marco Mascetti Mr Smith studio CEO affirm that “approximately **2.5 jars are sold every second**” (Mascetti, M. personal communication, April 19, 2009) . This means that in a year Nutella is selling more than **78.840.000 jars** which is enough to give the world 11.25 turns in a continuous line.

Of all these units that Nutella sells, almost all of them are made of glass with an internal aluminum safety lid and an outer plastic cap, as we can see in *graphs 3 and 4*, except for its **15g single-dose presentation** and its **3-kilo industrial presentation** that are made of **plastic**. Another exception in which plastic is implemented in the manufacture of the packaging as Marco Mascetti says is “when the use of this material is legally required by the recipient country to comply with standards as in the case of the US” (Mascetti, M. personal communication, April 19, 2009), where children are identified as the final consumer of the product and require resistant materials that do not break easily.

Regardless of the presentation in which this product comes, the most important thing and what will never change is its interior, the famous spreadable pasta invented more than 50 years ago. In *graph 5* we can see some of the ingredients that these packages guard so carefully.

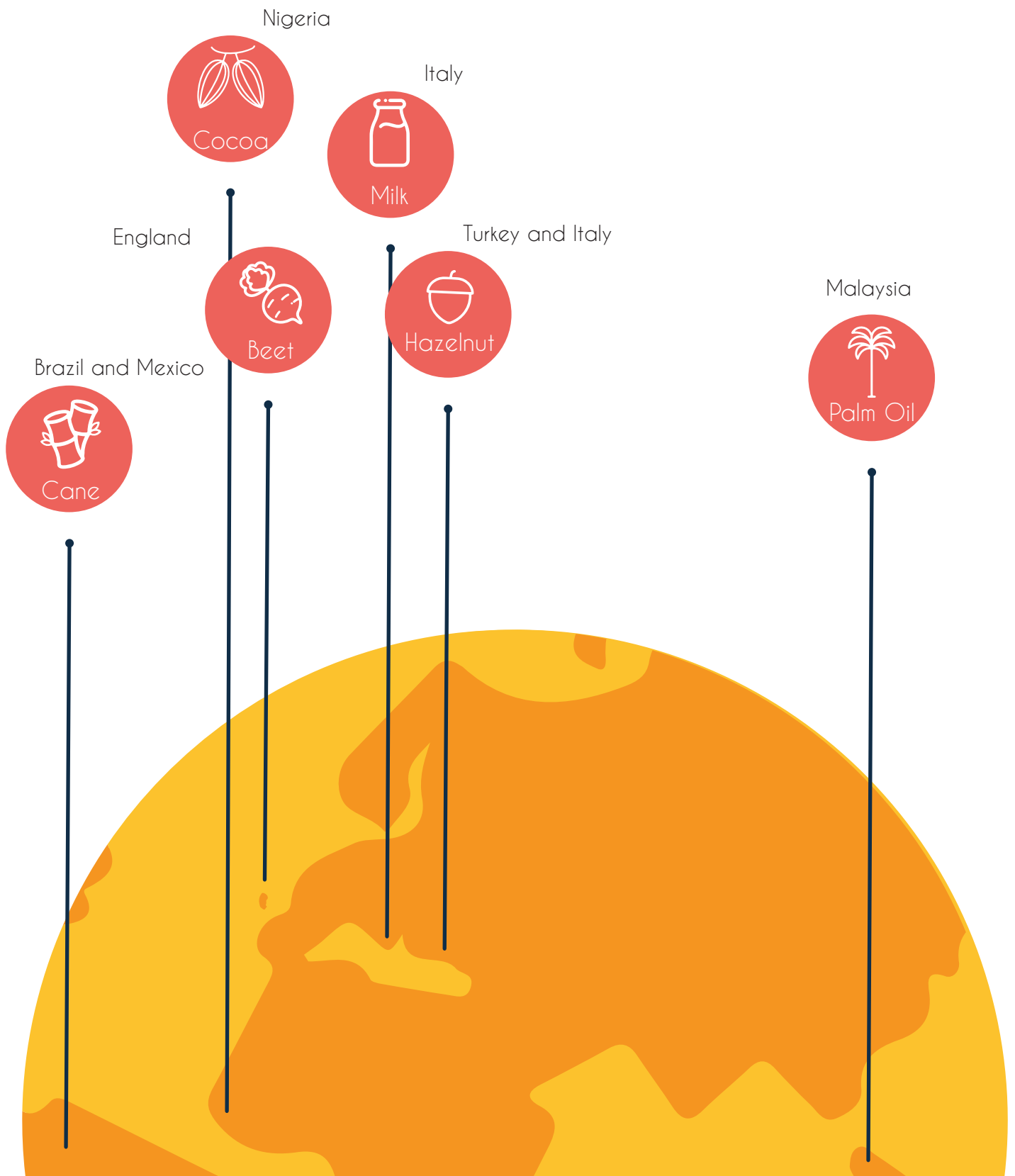
Apart from being a brand that is concerned about the packaging that will preserve its product, it also cares about the way it obtains and produces its raw materials, which has led Ferrero to establish a production model based on its global thinking and local acting, which has led during its expansion to open a series of production factories around the world to facilitate the handling of the ingredients and although some of them will always have to cross an ocean, this way it will be much easier to manage the distribution and sale of the final product.

Graph 5

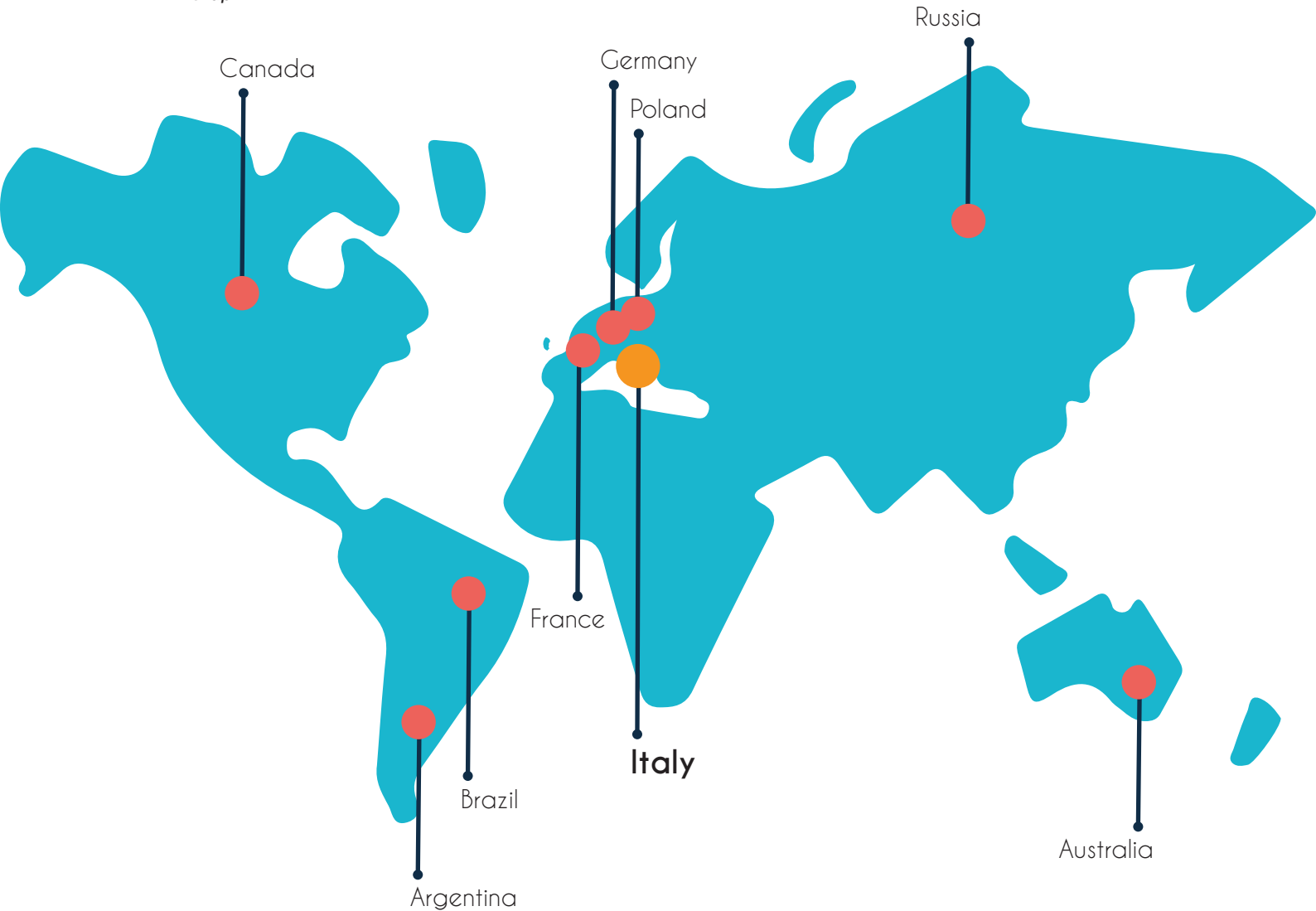


On some occasion everybody has heard that Nutella is a chocolate base or that it contains hazelnuts, but to make this sweet paste it will take much more than just this ingredient, that is why we will now try to deepen more about the raw materials for the realization of Nutella and give it the relevance of the production process of the 6 main ingredients where the majority of them need special conditions for their growth and production. Therefore Ferrero must turn to parts of the world where they can guarantee the quality and the necessary quantity of Raw material for all the manufacture of its products during the year.

Graph 6

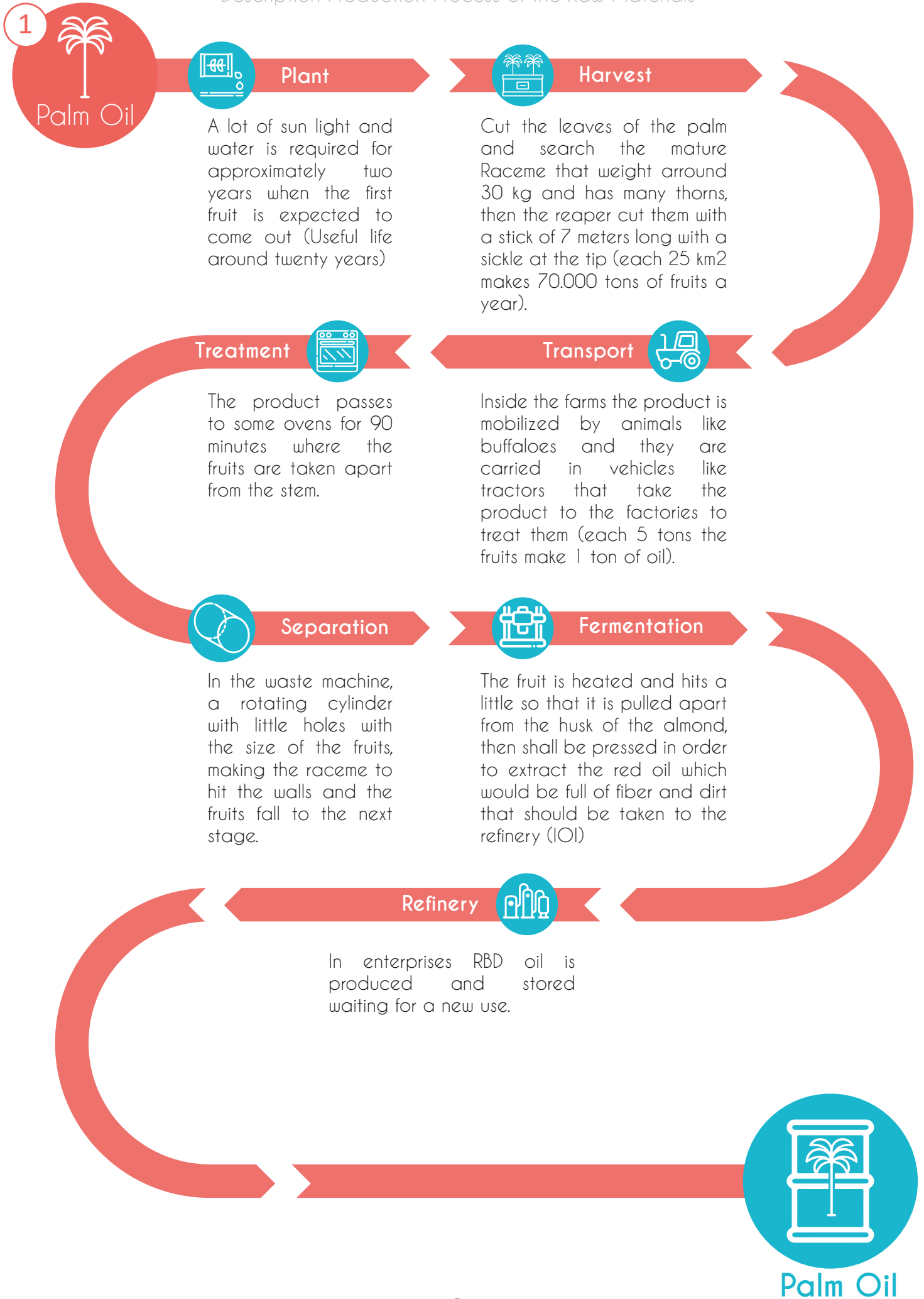


Graph 7

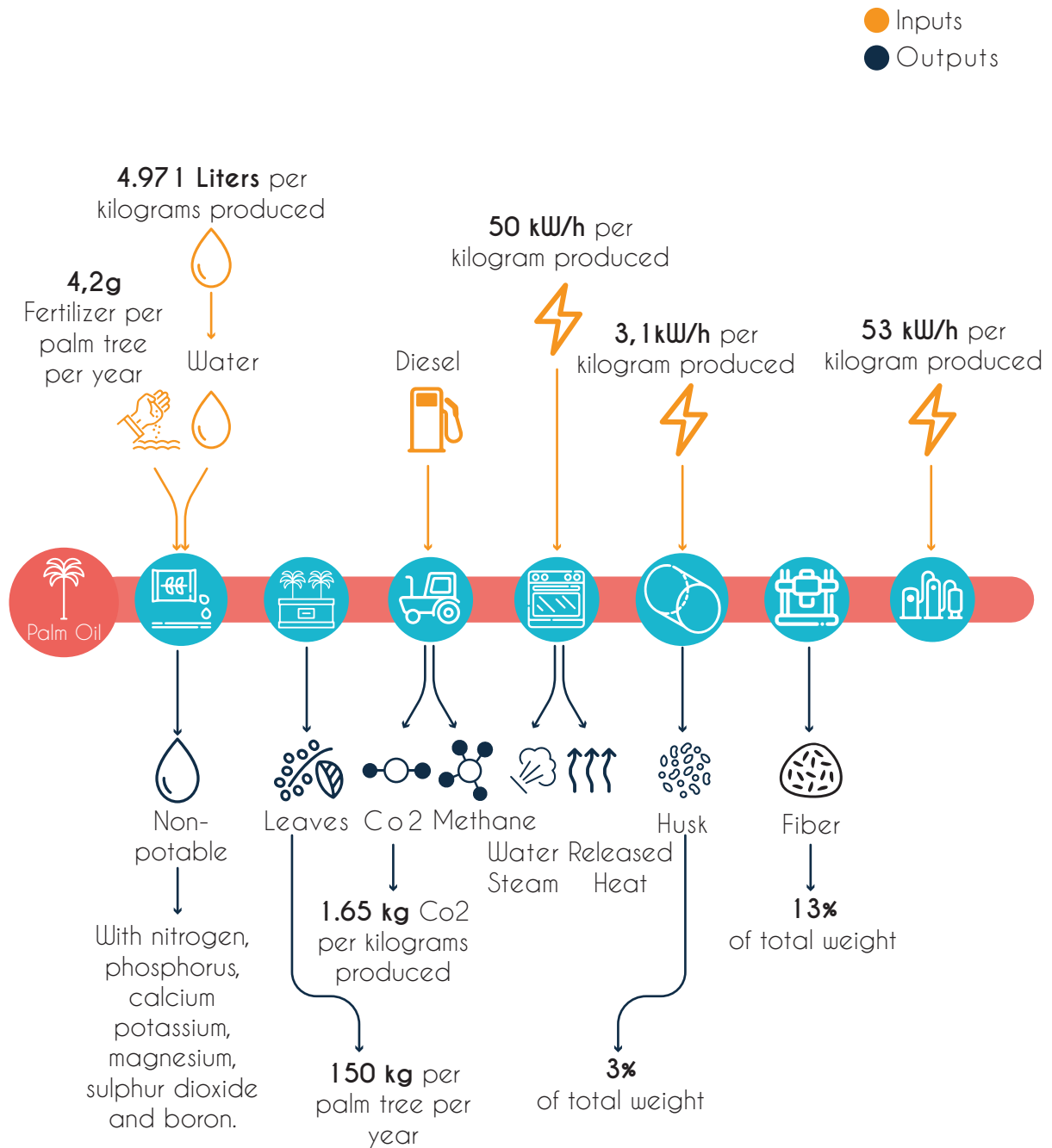


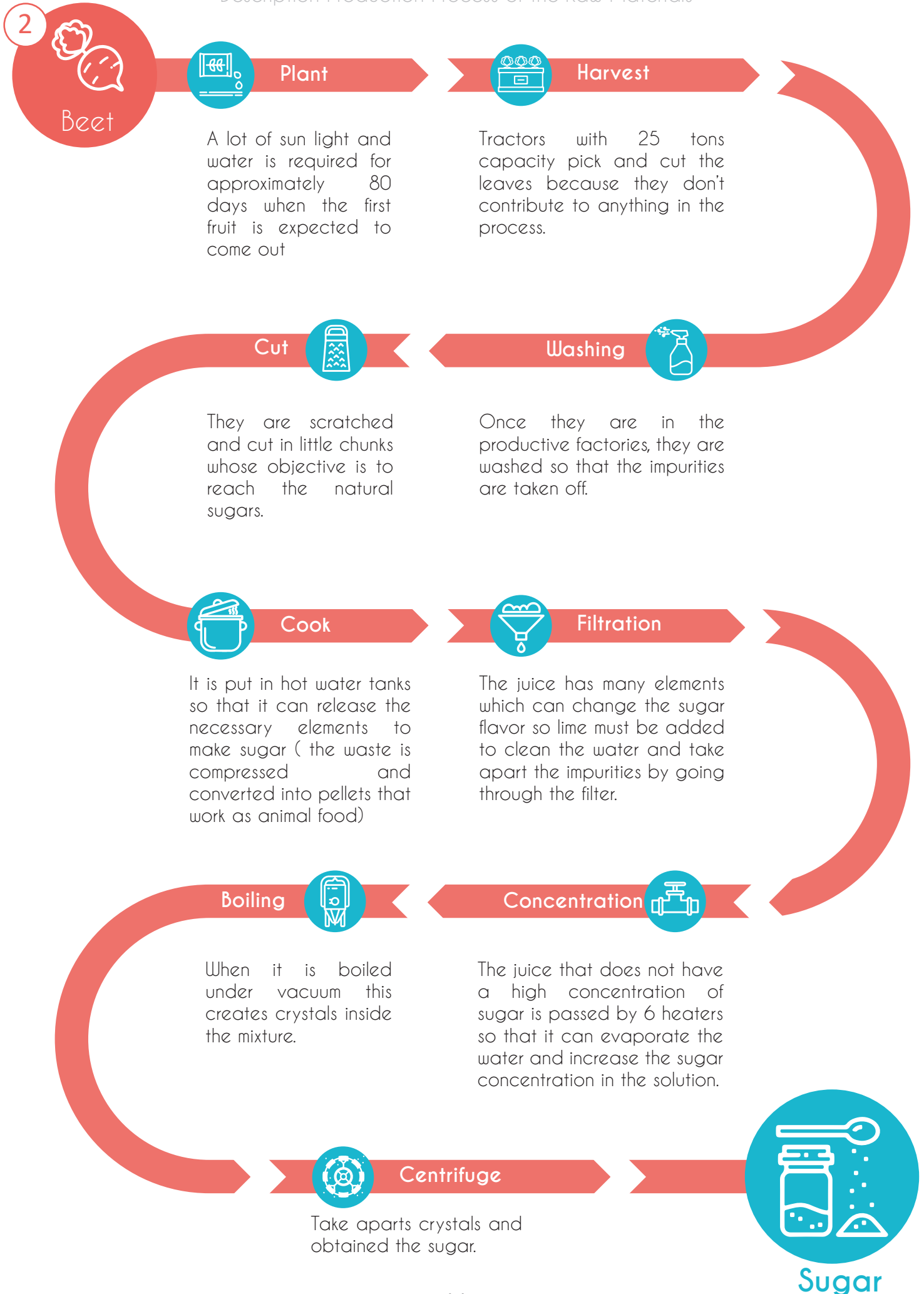
Looking at the graph on the previous sheet we can see that this company really depends on many regions of the world and, therefore, concentrating the post-processing only in one location would be difficult, directly affecting the products such as the increase in prices due to the complexity of the final distribution. This is why Ferrero decided to install some factories around the world to better manage some ingredients, but above all to manage logistics, although they still have to send raw materials across the oceans, it is much easier to manage markets in this way.

In *graph 7* you can see the 9 main Ferrero's production plants currently active in the world and although there are several and some are larger than others such as the one located in France, this document will be based on the production of the original **Ferrero plant in Alba**, Italy which represents 14% of world production turnover. We will also see the detailed production process of the raw materials and the final result.

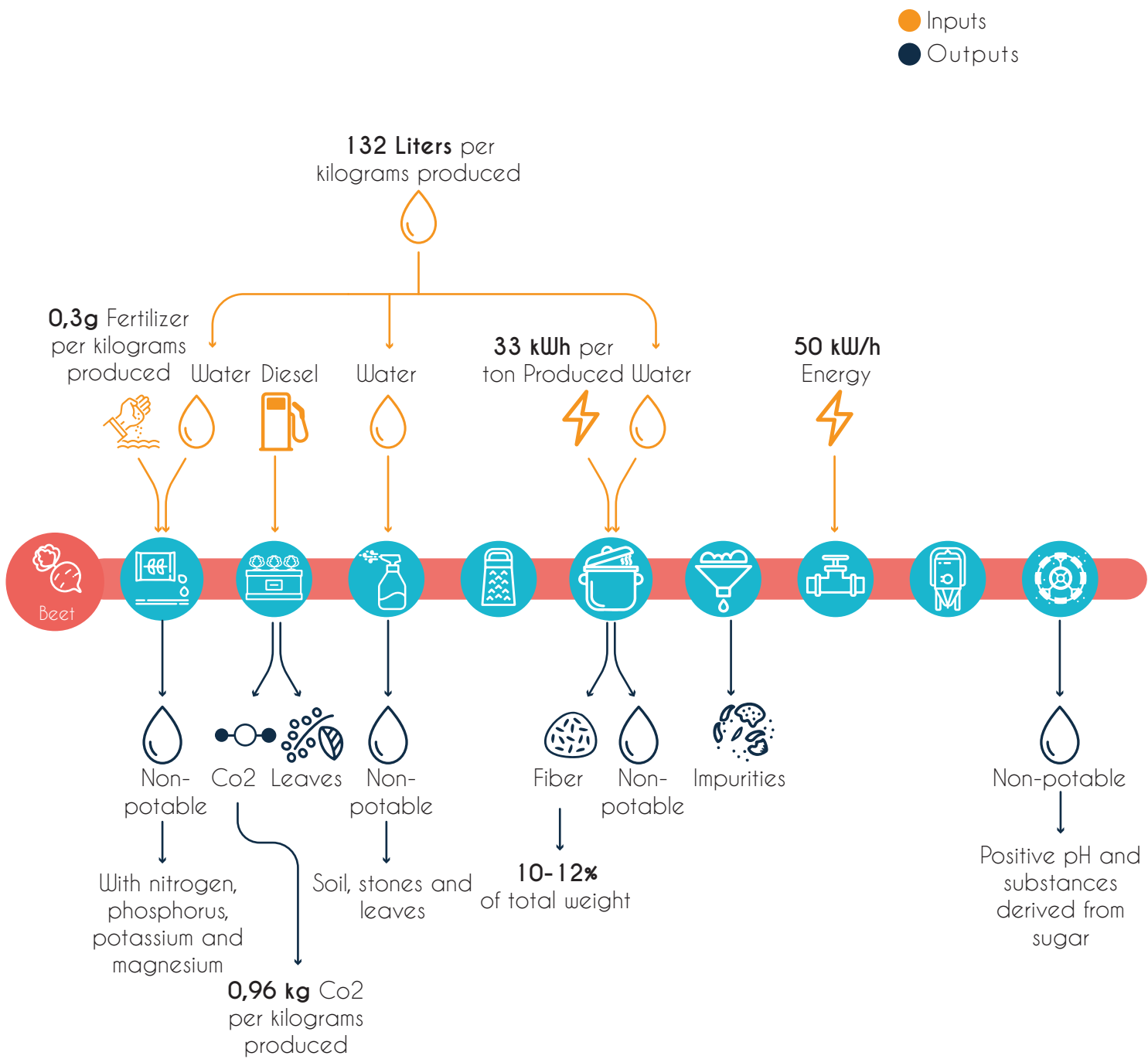


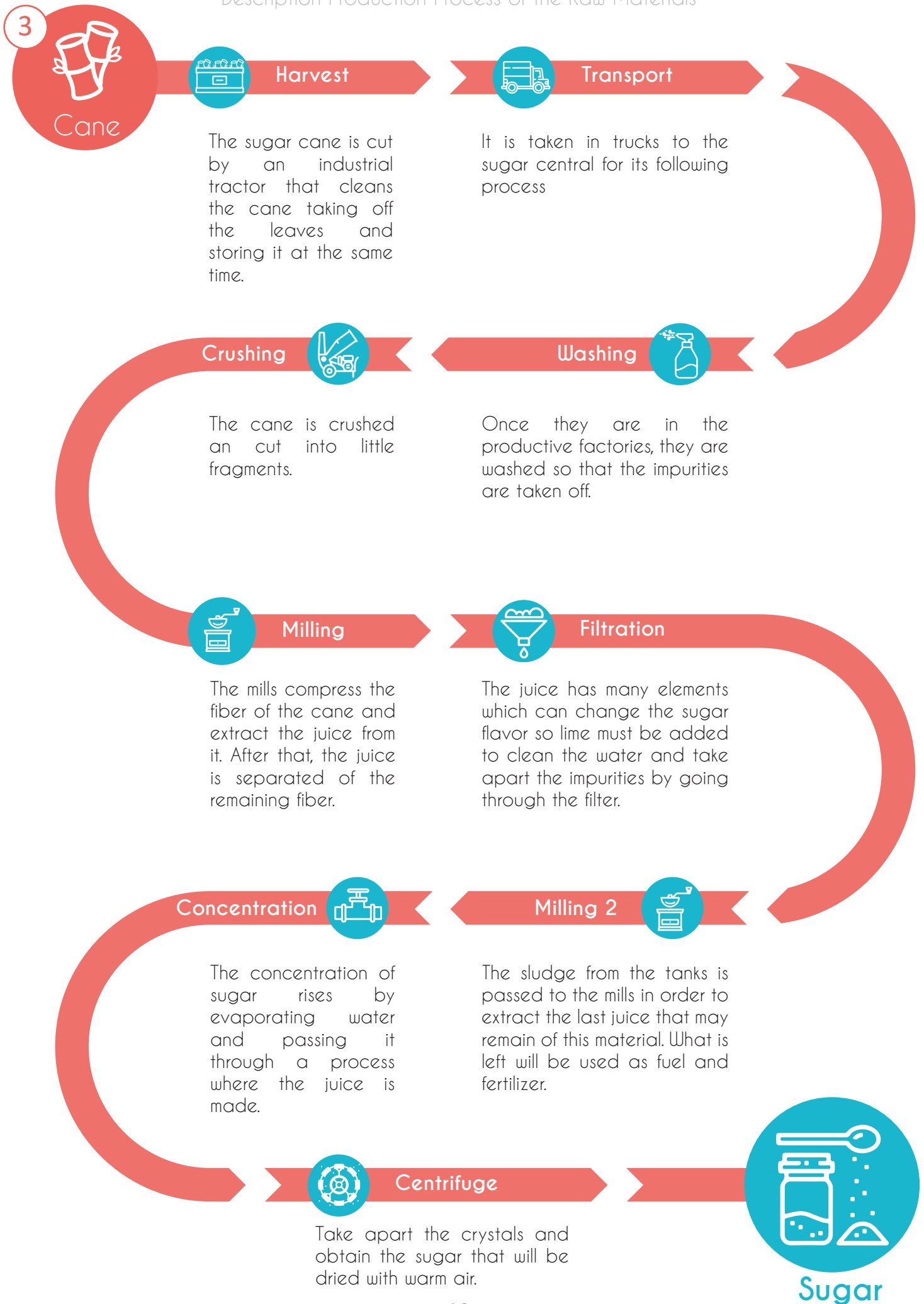
## Numbers Production Process of the Raw Materials



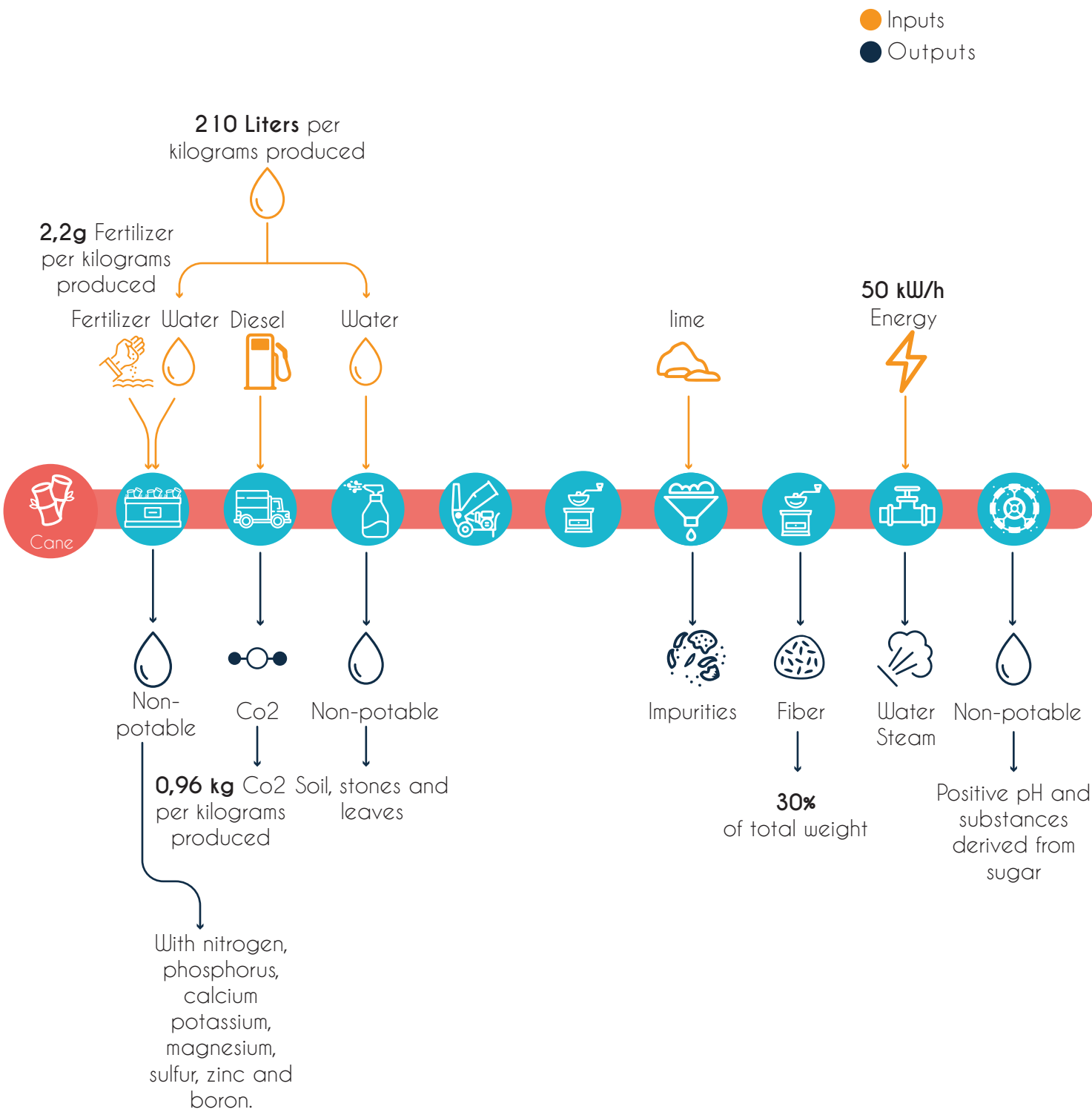


Numbers Production Process of the Raw Materials





Numbers Production Process of the Raw Materials



4



Hazelnut



Harvest

The seeds are taken from the soil with a tractor and then they are transported to the central farms.



Drying

The seeds are left in the sun to dry the husk of the seed which makes it easier to remove in the crushing process.

Classification



Once the hazelnuts seeds are in the factory a drum with holes of different diameters is in charge of separating them by size. Some samples are taken and go through physical, microbiological and chemical test.

Transport



Without the husk the seeds are verted into sacks and then they are sent to Ferrero factories.



Washing

Once they are in the productive factories, they are washed so that the impurities are taken off.



Roast

The hazelnuts seeds are toasted to enhance its fragrance. This process is also made close to the production line to reinforce the aroma in the final product

Pressing



The oily paste is compressed and tablets are made with them.

Crushing



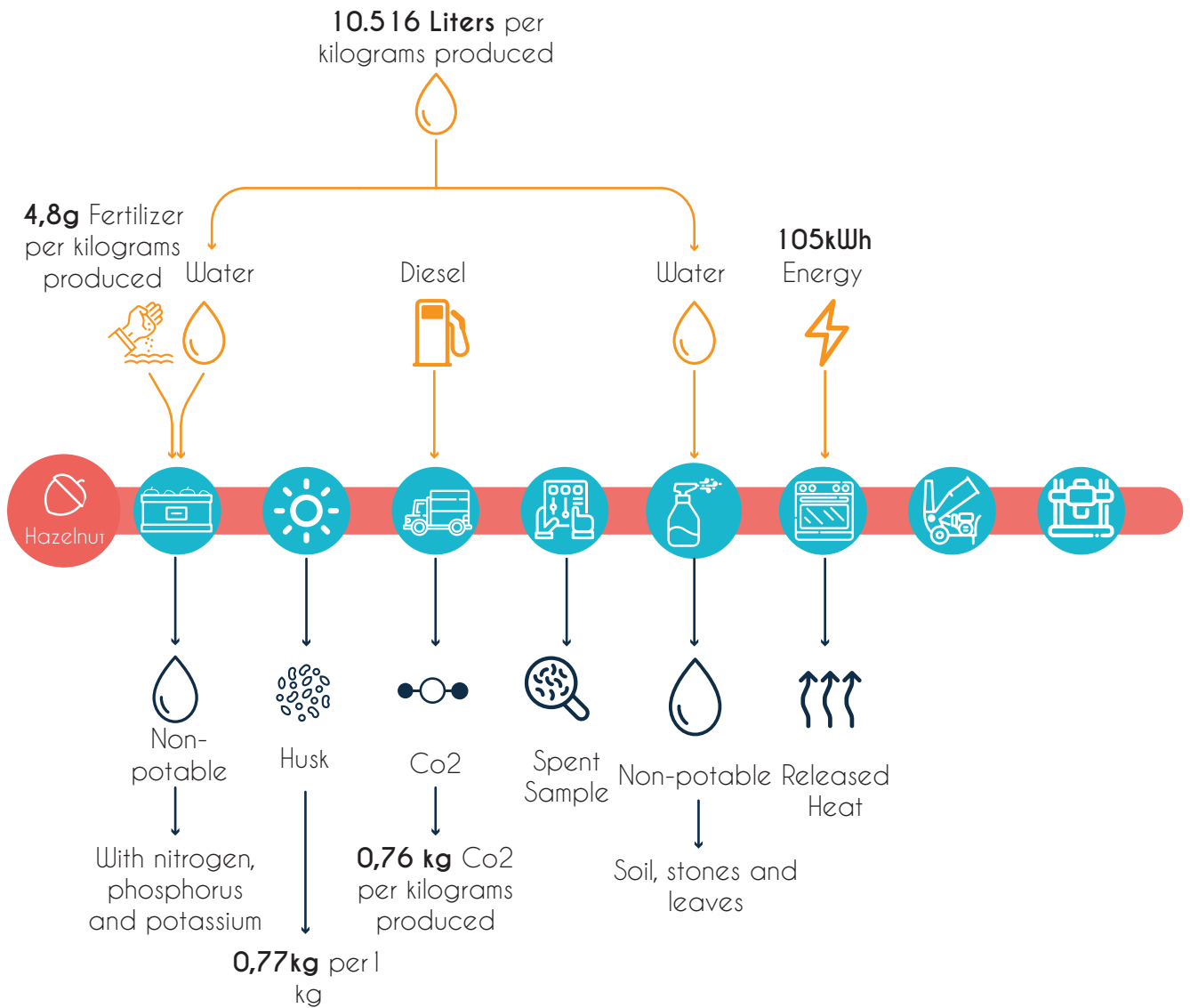
Like with the chocolate, the hazelnut is crushed with the objective of taking out the oil paste that contains the hazelnut.



**Hazelnuts  
Tablets**

## Numbers Production Process of the Raw Materials

● Inputs  
● Outputs



5



Milk



Transport

Fresh milk is transported in trucks in less than 48 hours after the production. The milk should be taken in the trucks at 4 C temperature so that it won't be damaged. After the milk is discharged, with a ramp that has 25 degrees inclination, the truck is washed inside and out.

Evaporation



The milk is passed through 12 tubes of 18 meters high at a temperature of between 70 to 45 Celsius degrees at vacuum conditions to pass the properties from the 88% of water to the 50%.

Pasteurization



The milk is warmed up to 72 degrees so that bacteria is eradicated in 15 seconds and then the milk is cold up quickly.



Spray drying

Process 240 tons of milk a day, for it to work 18 lances are adapted in the container where they will shoot the milk breaking it in little drops of 0,2 to 0,3 mm and then they are dried with hot air at a temperature of 190-200 Celsius leaving the milk with a humidity of 3% and with 97% sodium.

Bath



Leccitina is added to dissolve the fat and make the interaction easier between the water and fat.

Sifted



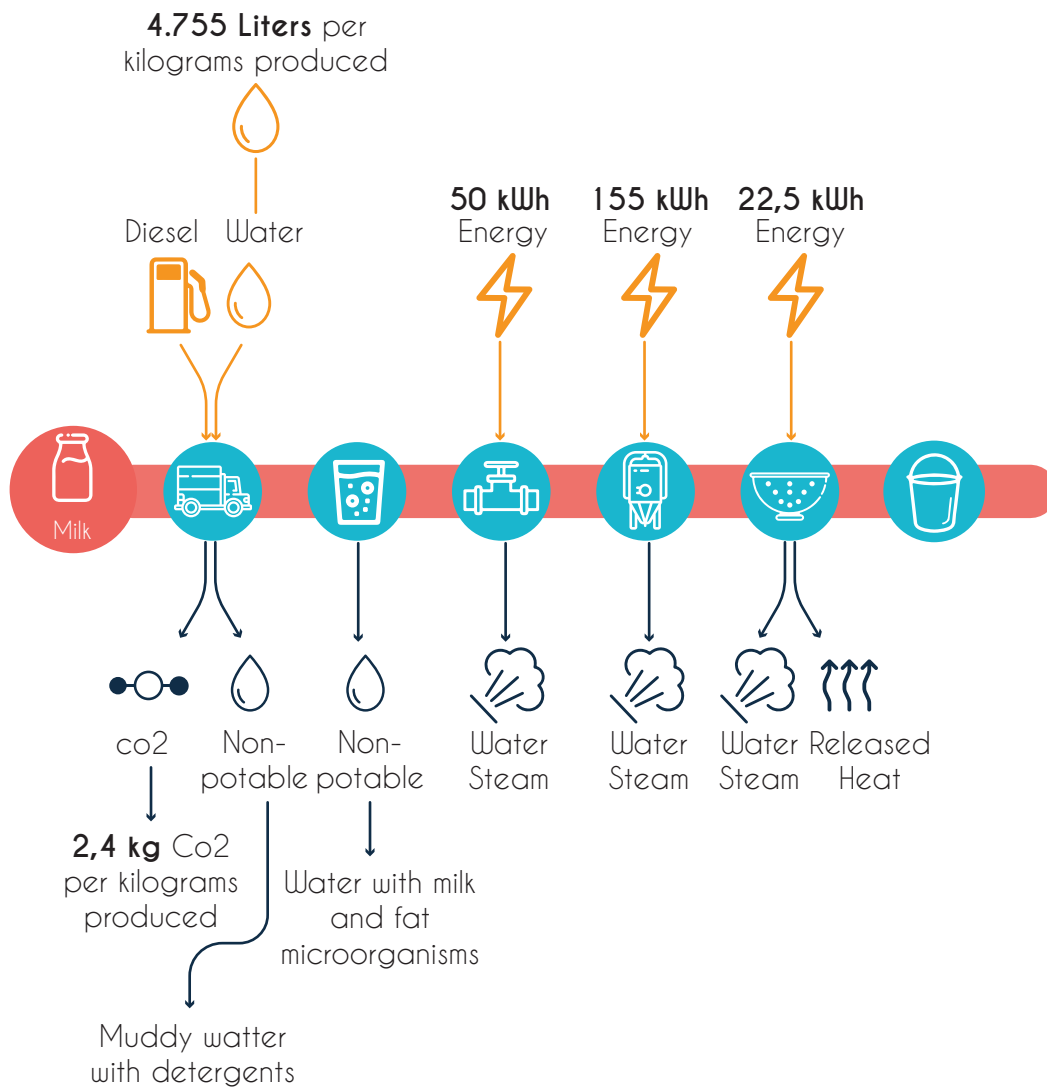
The particles that are between 100-800 microns are sifted and categorized so that the product can be packed.

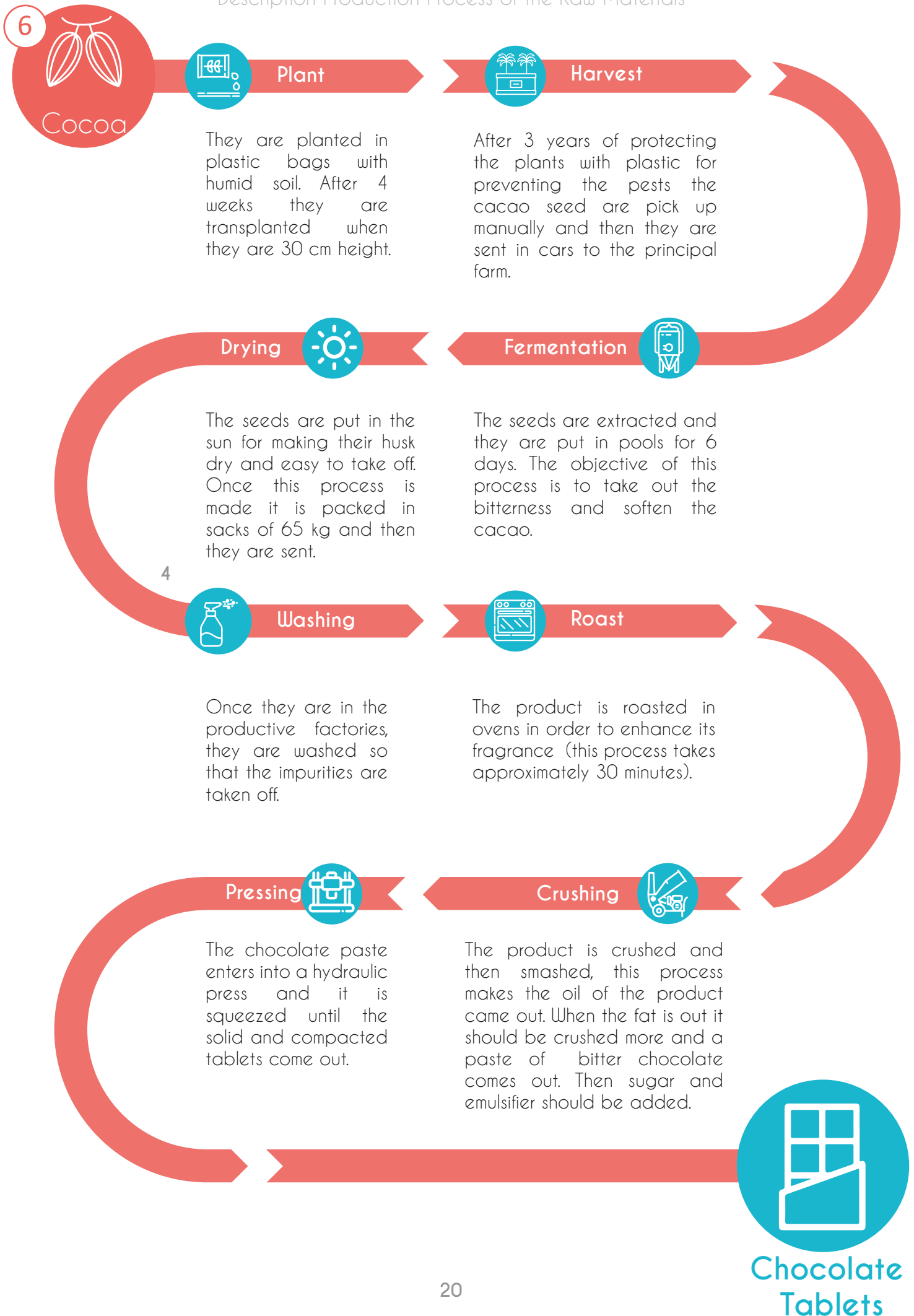


Powder Milk

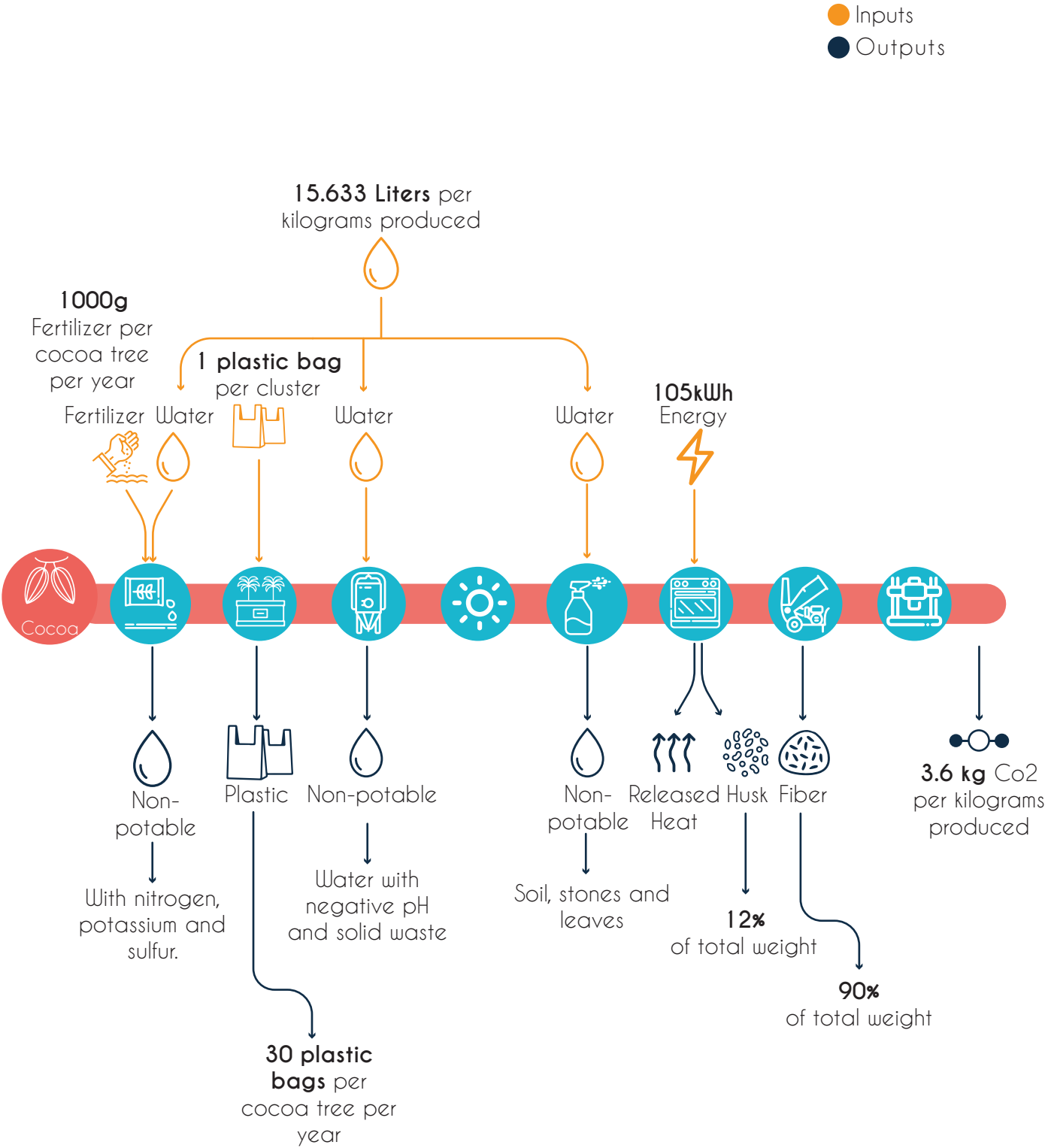
## Numbers Production Process of the Raw Materials

● Inputs  
● Outputs



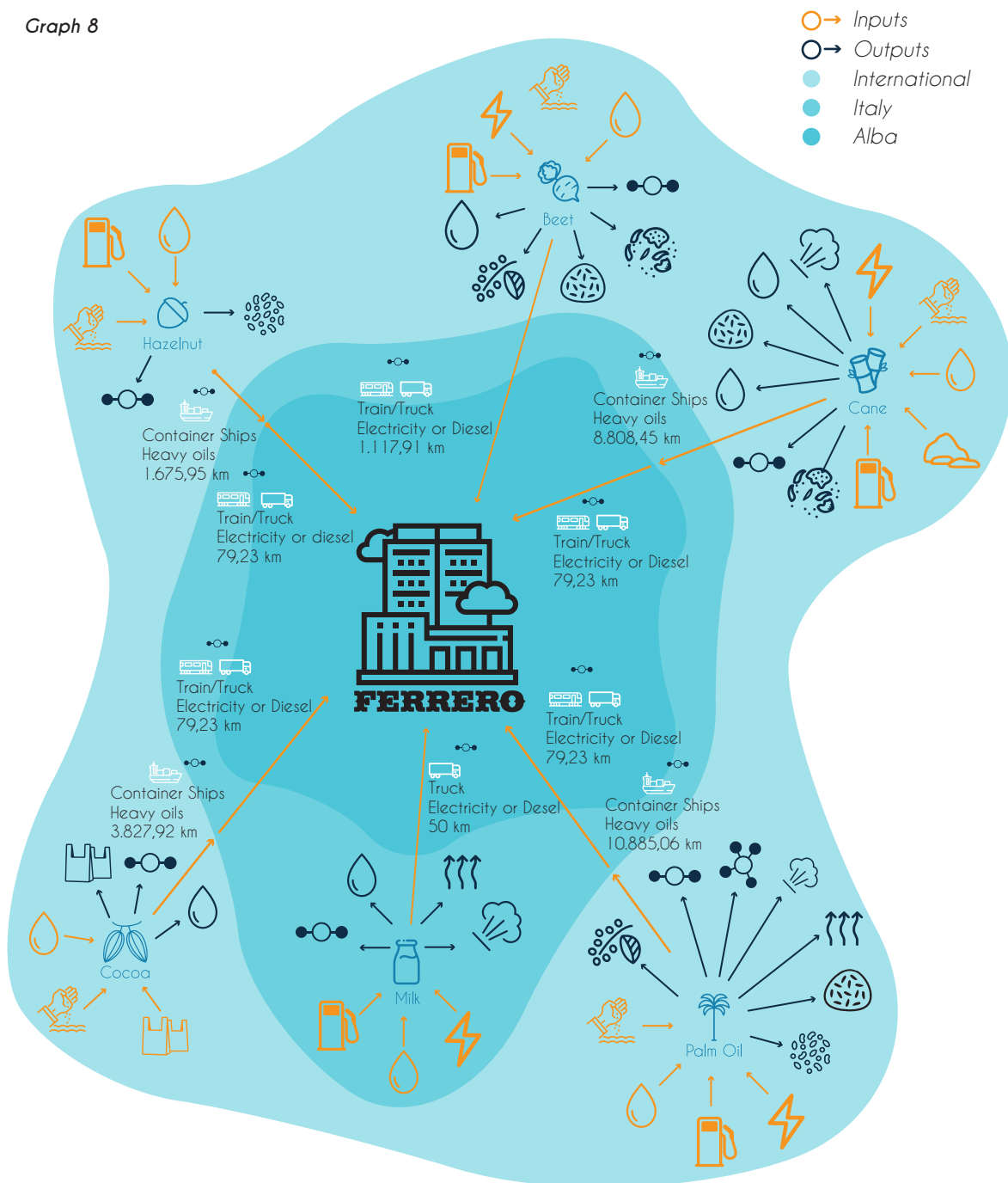


Numbers Production Process of the Raw Materials

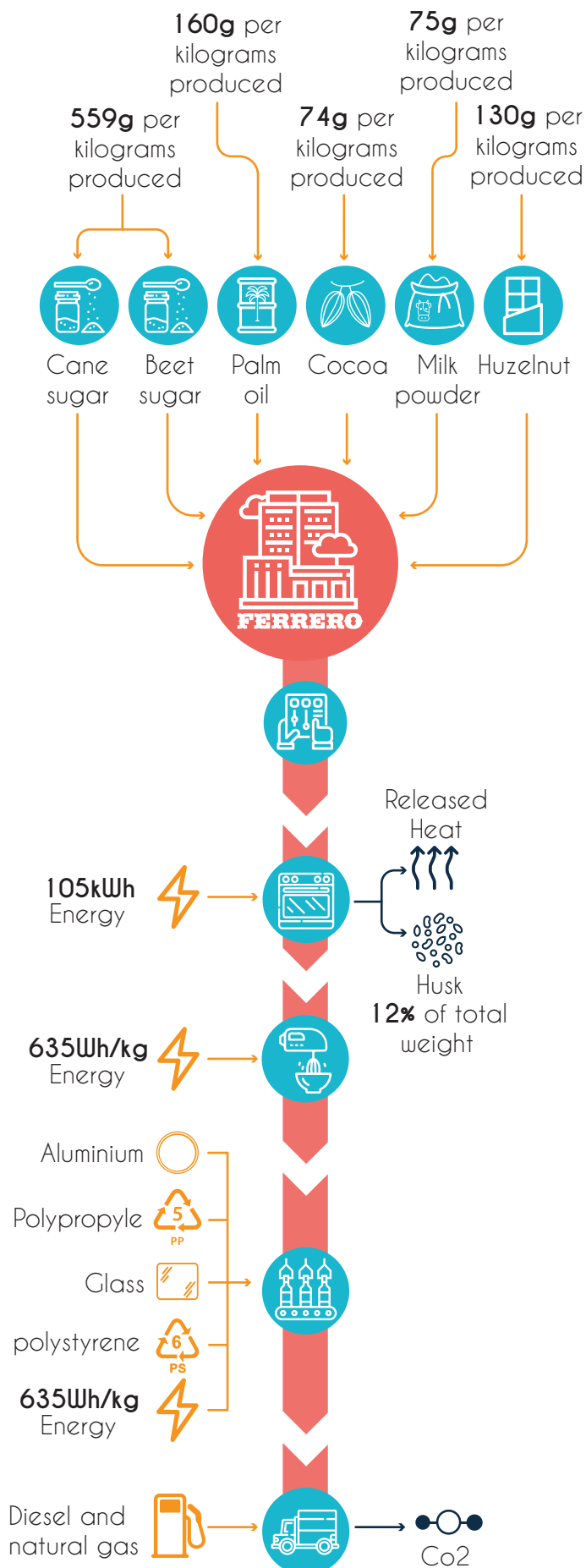


Once we have seen the production process of Nutella's ingredients, we can show the waste it generates, but with the previous maps we do not know where its impact is. Therefore, in the following graph it is divided between inputs and outputs related to the territories that Ferrero manages.

Graph 8



The internationality of Ferrero is evidenced with this diagram where at the same time it can be concluded the impact that can be generated in various parts of the world, but what about the local territory of production?. For this we will analyze separately the process that takes place at the local level, in order to see what are the impacts of the company directly related to the territory where the factory is located. For that we will see the following graphs to understand the production in Alba.



**Raw Material** Through different means of transport, as shown in graph number 8, the ingredients arrive at the production plant in Alba (Italy) where they will be subjected to the latest processes before becoming Nutella.

**Control** All the ingredients that arrive are subjected to a series of physical, chemical and microbiological tests to verify that they accomplish the quality level of the brand.

**Toasting** This process is only necessary for some ingredients such as cocoa and hazelnuts which are placed on a conveyor belt that moves gradually inside a hot oven to roast and extract all the aroma and substance of these ingredients.

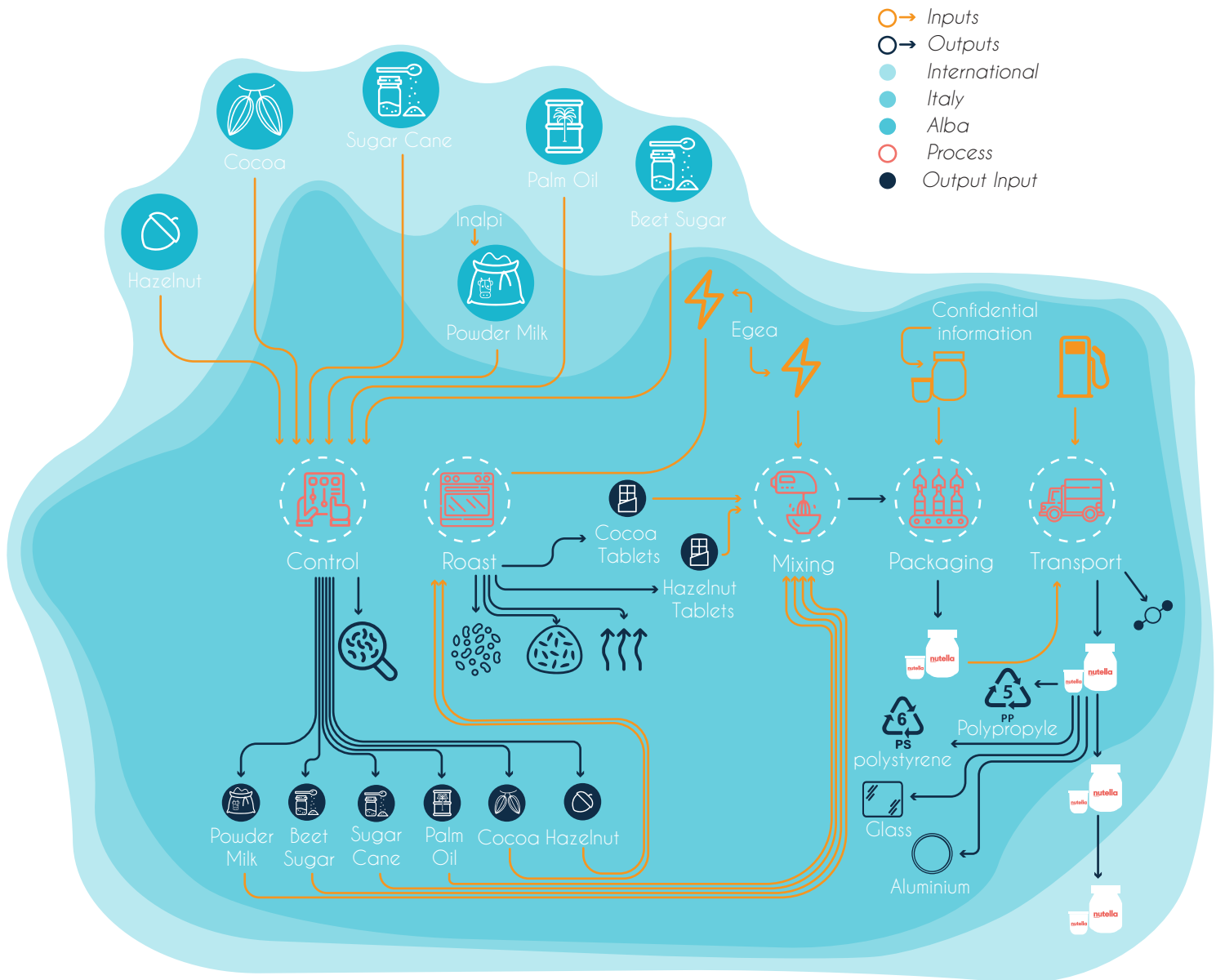
**Mix** The different ingredients, which come by separate lines, are joined in a large tank where they are mixed to create a uniform paste. This process results in a hot sweet paste.

**Packaging** When the spreadable paste is finally homogeneous, it is pumping in to the packaging with an automated machine into the different presentations.

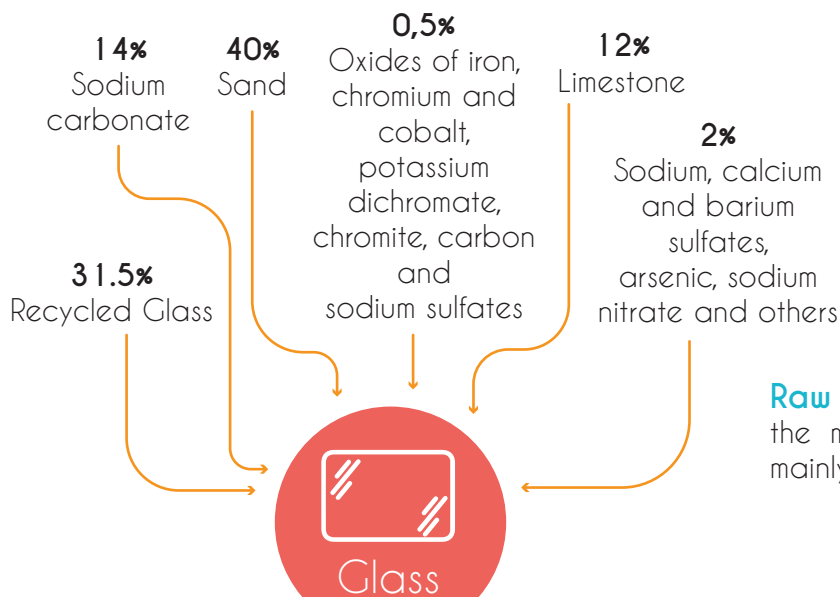
**Transport** The presentations are ready to be sent to the entire Italian national territory, some samples to France or Germany and in an insignificant amount to countries such as Sweden, the United States, Great Britain or China.

After naming the phases of the process in Alba, we bring a graph that works just like the *graph 8*, where based on each of the steps in Ferrero's internal process we can see the inputs and outputs, where this time some of the waste materials are converted into raw materials for other processes within the same system.

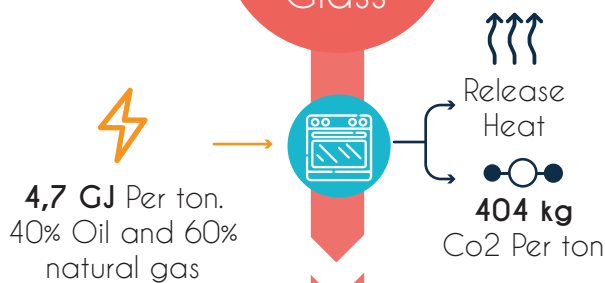
Graph 9



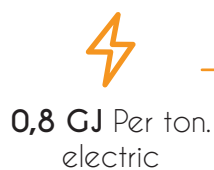
The appearance of a new exit is striking on this map, which doesn't appear until the penultimate internal process of the company, before the product is finished and leaves the factory. The Nutella packaging is the only one among all the graphics to be present in the 3 radios, giving an alert of the impact that this object and its process can probably cause. Therefore, although this element is not directly involved in the production of this sweet paste like the previous 6 ingredients, we must deepen on it because although this cannot be tasted, it does fulfill the function of protecting the interior, playing a main role in the whole final, called Nutella.



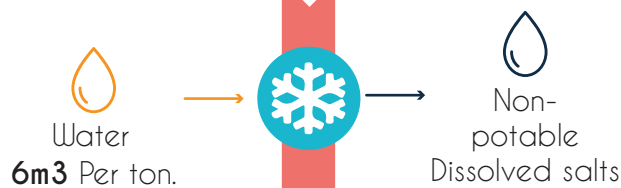
**Raw Materials** It is born from the mixture of various materials, mainly from silica sand.



**Oven** The mixture is introduced in large ovens at about 1500C to 2000C to achieve the plasticity of the material.



**Moulding** The material that looks like lava is passed through a dice where it is blown with air and the shape required is obtained.

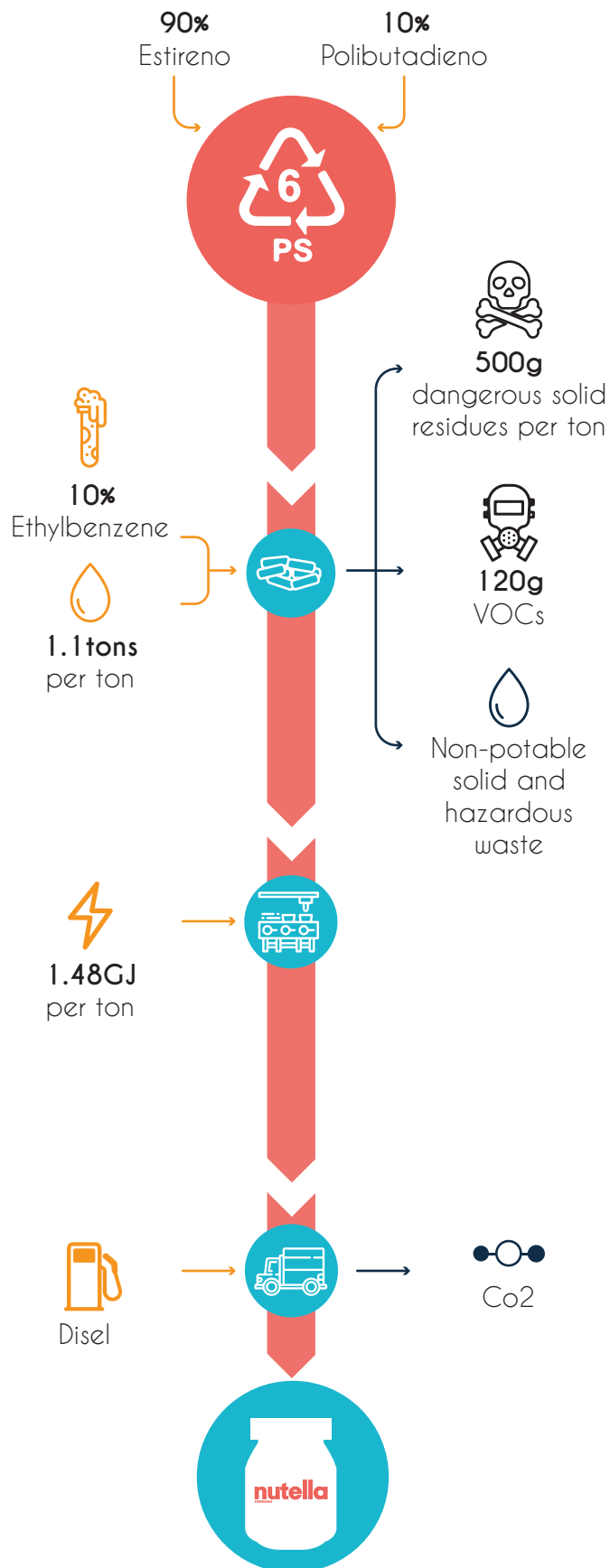


**Cooling** The finished pieces are cooled so that the package does not lose the given shape.



**Transport** The location of the producer of the packaging is confidential but it is known in Europe there are two plants, one in Germany and one in Italy at dawn, so the packages will not have to travel more than 50km for this production plant





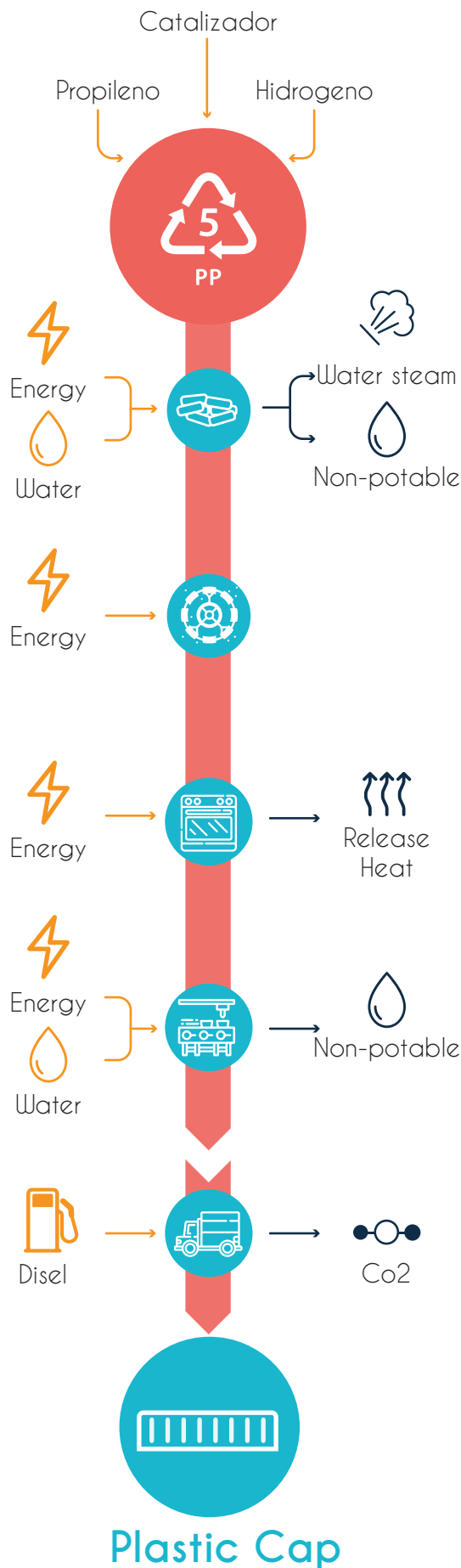
**Raw Materials** The substances are introduced into reactors.

**Siteization** Once the substances are in the reactors, a maximum of 10% ethylbenzene is added, which serves as a stabilizer. The process occurs at about 180C and reaches up to 1MPa of pressure

**Moudeling** The material is used in sheets of low thickness which opens the possibility for the implementation of stamping production model, where some dice, which have a preset figure, hit the sheets of polystyrene heating it and print the shape.

**Transport** The location of the producer of the packaging is confidential but it is known in Europe there are two plants, one in Germany and one in Italy at dawn, so the packages will not have to travel more than 50km for this production plant

## Polystyrene Package



**Raw Materials** The substances are introduced into reactors.

**polymerization** Propylene has several ways of polymerizing in this case we refer to the suspension method which is given at a temperature of 70°C with 4MPa of pressure. In the course of this process it has several steps where evaporation and washing stand out to leave the product ready for the next stage.

**Centrifuged** This process is very similar to what we have previously reviewed in the manufacture of sugar where the product is released from the liquid that contains and generates crystals, this time called pellets






**Oven** Once the polypropylene is created, it must be heated to approximately 150 degrees to achieve its plasticity property and give it the desired shape.

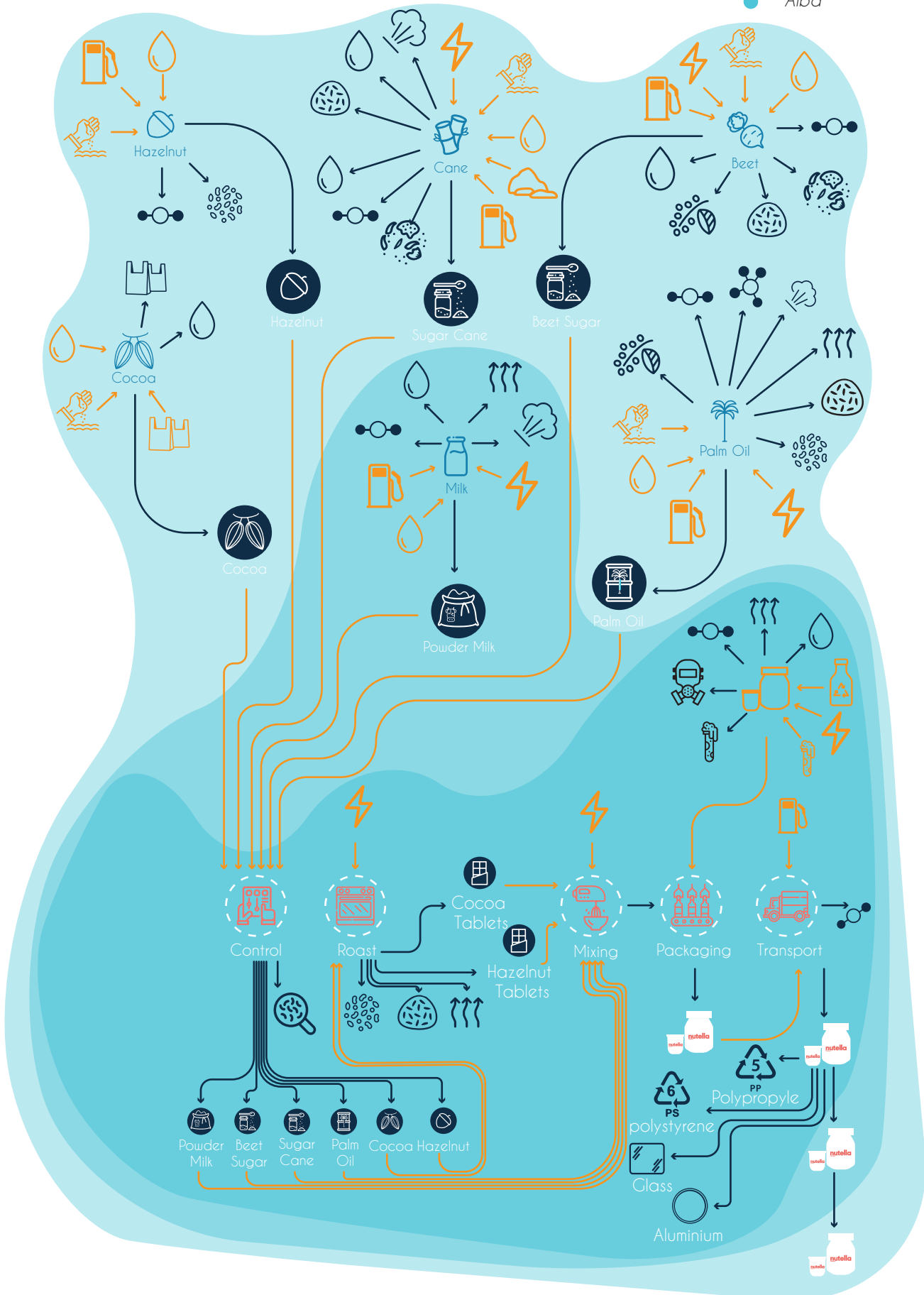
**Moulding** For a mass and rapid production of lids, the injection technique is used where polypropylene is supplied through a machine which is injected into a chamber with a preset shape.

**Transport** The location of the producer of the packaging is confidential but it is known in Europe there are two plants, one in Germany and one in Italy at dawn, so the packages will not have to travel more than 50km for this production plant

# RESULTS

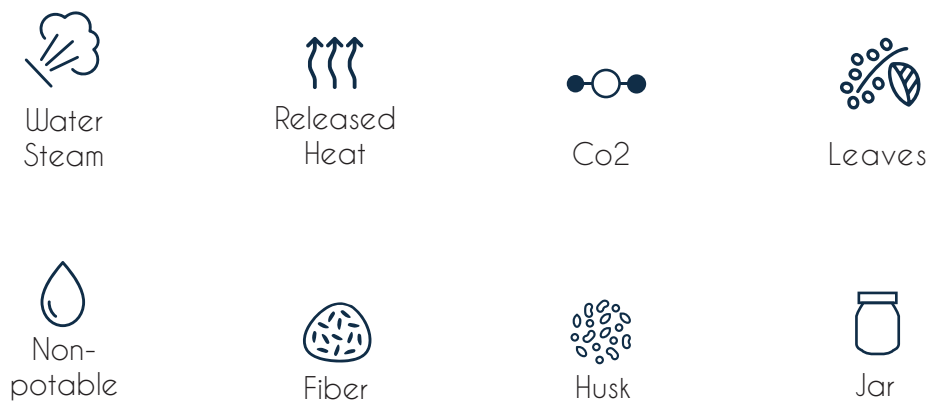
Graph 10

-  Inputs
-  Outputs
-  Process
-  Waste Input
-  International
-  Italy
-  Alba



Leaving behind the process detailed by products and stages, presented in chapter two, we will now begin to talk about the results that the production phase of this company leaves. For this we have gathered all the maps made, as can be seen in the *graph 7*, presented on the previous page, to give an overview of the Nutella production process where we will identify the main waste, trying to give it a new connection in the system and if one is not possible outside of it, this with the intention of transforming the image of the waste into a concept of recycled input.

During the conduct of this investigation we have seen the presence of several Inputs that, depending on the stage where it is identified, requires a greater or lesser amount, but regardless of this they are usually used for the same in the system leaving repetitive outputs throughout the process as :



These outputs are characterized by having been present from the beginning to the end of production with the exception of few such as the packaging, which only makes presence in the penultimate with a curious effect where it becomes present in the different radii of the diagram, being a case worth adding to the study regardless of the difference in its nature.

In summary in this chapter we will try to understand the nature of these eight types of waste that today are seen only as this, but in reality they have much more potential both for the reduction of the environmental impact generated by Ferrero, and for the creation of added values to the company's products, in this case Nutella. For this we will go deeper on each of these elements trying to get a new alternative to the service of the company where we hope to play an important role not only to reduce costs, but also to reduce the amount of raw material required for its processes, making its evident the linearity to a systemic process, a probably more complex network of interconnections and solutions to current problems that are surely not obvious to the company but that if taken into account can bring positive results for it.

Once clarified this we will begin the analysis of each of these outlets starting with the water vapor until it reaches the Jars.

Water vapor is an output that is found in three of the six ingredients analyzed, especially in the milk process where it has a strong presence. This residue can be identified in the transformation phase of the raw material with the energy input.

But what is water vapor? It is the transition from the liquid to gaseous state of the water where the bonds of its molecules are broken with the help of the introduced energy that is transformed into heat, heating the water and stirring its molecules that absorb the applied energy and concludes in the rupture of its links since it does not have time to repair its joints, changing the state of matter and producing the evaporation of water, leaving a characteristic semi-white gas.

Once released into the environment, this gas will lose more or less energy depending on the outside temperature. Once lost, it will begin to reduce its molecular size and create the links to go through the condensation process.

Seeing this we can ask ourselves why do we pay so much attention to a byproduct that is just water? As well as being a clear loss of energy for the company as it already releases a lot of the energy invested into the environment, it also increases the temperature of our planet. This has nothing to do with the steam coming out hot, this is actually part of the greenhouse gases, being one of the most problematic because of the conditions of our planet, where it occurs without any control since 70% of the planet surface is water, which causes nature itself to produce large quantities.

It is here where we see the need for the intervention of the human being so as not to contribute to the production of this gas, which in its fair measure is necessary to maintain the optimum temperature on the earth's surface that helps to give the optimal characteristics for life and that is unbalanced with its overproduction.

What do we do with this gas? There are currently several alternatives for the management of this gas since it is actually a result of activities necessary for many processes and that we cannot often avoid or eliminate in small-scale processes such as the breathing of living beings or large-scale such as Pasteurization of food. This is why many people have tried to give it a use and have come to propose the following:

**Vacuum steam:** with this technique the gas can be captured and when subjected to vacuum conditions the pressure exerted is varied in order to control the temperature and create a type of oven.

**Boost or movement:** it is one of the most common uses for this product and is used long ago to generate movement such as turbines for power generation. This does not return the energy inside the steam, but it does create a new source, mitigating the one that is being lost.

**Fluid movement:** it serves to generate driving force that helps create voids in pipes that help transport liquids from one side to another.

**Atomization:** it can be injected into liquids to break them and create small drops for optimization as in the case of oils.



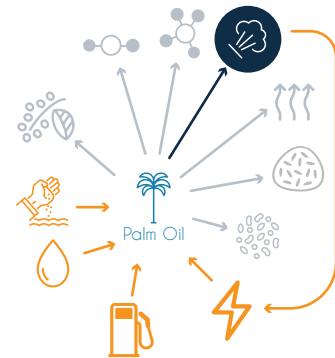
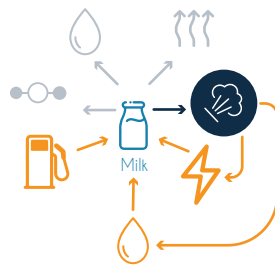
Water Steam

**Cleaning:** used to clean boilers and chimneys eliminating soot.

**Hydration:** it works in some processes to moisten the raw material without overloading them with water and damaging them. An example is the production of paper that needs to be dampened a little so that it does not tear and break in its movement by the machines.

**Heat exchange:** can be used to transfer the internal energy that has been absorbed to other products without the need for so much new energy.

Once these possibilities are stated, we will try to find the precise connection to this output in each of the steps of the respective processes where it is presented. In case of not having a possible connection in the system an external solution of it will be sought.



In the case of sugar cane, the resulting steam can be used as heat exchange where instead of releasing the steam this can be captured and injected into the walls of the tubes to raise its temperature transferring its energy decreasing the use of new energy to arrive at the temperature required.

As in the case of the cane, the steam can also be used for heat exchange but we can also use it in an innovative system to clean the trucks that carry the milk daily to the factory, reducing the consumption of water and taking advantage of sterilization benefits from the heat of the residue.

In this process it can be used in two ways, the first in vacuum ovens that would reduce the amount of steam necessary and would have benefits like controlling the temperature that is required. Once finished cooking, this steam can be stored and sent to provide energy to start momentum helping to move the drum that classifies the almonds from the palm clusters.

The second waste is the residual heat, an output that is evidenced in five processes of the seven elements for the production of Nutella, the result of the transformation of energy into heat based on the laws of thermodynamics, this result is used in the process of roasting or cooking, in these cases by using ovens for the processing of raw materials.

This is considered a problem especially because most of the energy used is wasted after the process by the leakage in the form of heat that is released into the environment since it is considered a waste with very little work capacity. This situation mainly affects the pockets of the company, but in turn it presents collateral impacts on the environment.

Some of the impacts that this waste has are related to one of the practices for disposal where it is released on liquid surfaces such as rivers, seas or lakes for them to contribute to the rapid loss of the energy that is stored, but this causes elevations in the water temperatures that cause problems for ecosystem species. On the other hand there is also a phenomenon called the island of heat, a phenomenon starring the sun rays that strike day after day in the cities. These rays of light are charged with energy that is absorbed by the materials that are in it and are reflected in the form of heat. But what does this have to do with the wasted heat in ferrero production? Experts also claim that human and industry activities collaborate with this phenomenon that heats cities in the day and is only released at night and in the early hours.

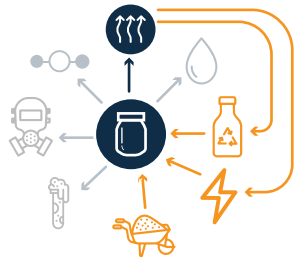
Currently, some solutions for the recovery of this output are the production of internal heating of buildings, the production of energy by means of thermo galvanic cells, the preheating of a material or liquids, and in greenhouses. Now in the Nutella system this waste can be recovered in the different stages in the following ways:



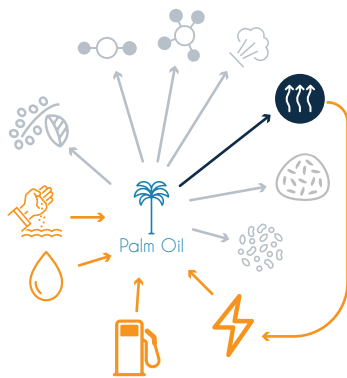
In the first case we can see a waste of heat in the drying of the small particles that are being sifted where this heat can no longer be used after they are dry, but that it can be transferred to the pipes that are close to it to raise their temperature and require less new energy to reach the required temperature.



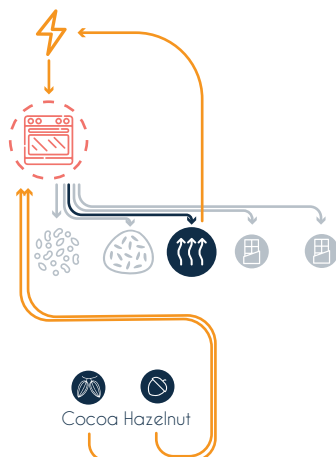
Released Heat



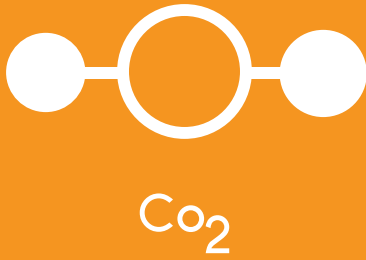
This time the process has two viable solutions: energy production and preheating of the materials to be melted. In the first case the energy that is expelled every day in the production of glass can be redirected to a special section where thermo galvanic cells will be installed and will convert the temperature difference into an electric current that will reduce in some way the need for new energy for this process. In the second case the heat will be transferred to the storage place of the glass that will be recycled to raise its temperature, preheating it so that when it reaches the oven it is somewhat hotter than usual and so it must spend less time in the oven, meaning a large energy saving for the company.



In the third, as in the previous one, it can be used for the preheating of the steam that will be introduced into the furnaces for the treatment of the fruits of the oil palm, replacing a part of the amount of new energy required to obtain the desired temperature inside the ovens. To better understand this use we have to take into account the idea raised in the section of steam outputs where there the idea of implementing a steam oven is mentioned, which must evacuate all this gas before opening. This is why the heat must in turn go out with the steam that will be transferred to a storage place with a special material that absorbs it and keeps the temperature of the steam at an ideal point to avoid the loss of its temperature and require less energy at the time of reuse.



In the last one, it has the peculiarity that two ingredients are presented in the same process and also for the first time we are analyzing outputs that are generated directly at the Ferrero factory in Alba. Here in the process of roasting cocoa and hazelnuts there is also a loss of energy that in this case we can take advantage of with the production of energy for the reduction of virgin energy required to bring the ovens to their ideal temperature. For this, the same method mentioned above will be used where the heat will be redirected to a special space where thermo galvanic cells will be installed and will convert the temperature difference into an electric current.



The third residue we will talk about is one of the best known outputs worldwide and is credited with being one of the main responsible for global warming. Co<sub>2</sub>, a gas belonging to greenhouse gases that occur naturally on the planet. However in recent years the amount of CO<sub>2</sub> produced has risen, for example, from “0.5 parts per million (ppm) in 1960 to 2 ppm in 2000, a trend that is maintained today due to human activities” ( El gas del cambio climático marca un récord nunca visto en la historia humana. May 15, 2019). Therefore, for this residue we will concentrate only on anthropogenic sources, excluding natural sources of co<sub>2</sub>, and we will talk about those that are produced by industrial processes such as the one for Nutella.

Ferrero is not exempt from the production of these gases, which it generates particularly in its transportation system of raw materials established to the factory and in the final distribution of its products. A system based on the current energy supply model closely linked to fossil fuels, generating tons of CO<sub>2</sub> to the environment.

This has been troubling the planet for several generations and we have established various initiatives to reduce these emissions, such as the Kyoto Protocol held in 1990 where countries committed to reduce their CO<sub>2</sub> emissions and set a production limit for these by country and year. But this has not been efficient and nowadays continuing with the same political and economic interests that has kept us from fulfilling the task proposed in the 90s.

We must also clarify firstly that this gas in its right measure does not represent a danger to humanity and it is so that some organisms such as plants can process it and maintain a balance in the planet that reaches a pleasant temperature on the Earth surface that makes it easier to develop life in it. But the problem is that when this amount is altered and the carrying capacity of the ecosystems is exceeded and the resilience property is exceeded, the concentration of CO<sub>2</sub> begins to increase, affecting not only the contribution to the increase in temperatures in the world by more than 1 ° C but it also brings consequences such as the greater intensity of meteorological phenomena, impacts on biodiversity and even geographical changes where water levels rise and current land coasts disappear.

This is why some people in the world have been concerned and have proposed solutions to mitigate and reduce the impact we are generating. Unfortunately, many of these processes are very expensive and generally need large spaces to be able to run, this being one of the reasons why in this analysis we cannot propose a reuse of this output within the same factory.

Even so, we will bring up some state of the art techniques that are likely to be more accessible and affordable in the future to be established and generate new partnerships between Ferrero and other external companies.

One of these new proposals is the imitation of photosynthesis of plants where, with a large co<sub>2</sub> collection tower, it can be stored and subsequently used to create sugars in a bio imitation process where it will be catalyzed with a metallic compound called “Tungsteno – Diselenido” transforming carbon dioxide in carbon monoxide that

can easily be transformed into fuels such as methanol.

Another innovative solution that can be made today is the collection of CO<sub>2</sub> as well as the previous model with an absorption tower, but this time for the implementation in the process of carbonization of beverages such as soft drinks or beers. If this were to be established, Ferrero would have no problems to market with this product and allies could arrive such as Baladin, an Italian brewery with one of the most systemic systems in the region and that makes the carbonization of its products from waste.



But not everything is lost, for now Ferrero can respond to these needs with the planting of new trees and plants that compensates for its carbon footprint, with the hiring only of certified companies that cover their carbon footprint and try to change their fleets of transport to less polluting ones, such as electric vehicles.

The following residue does not represent a problem of such relevance or importance compared to the previous one, but what they do have in common is the opportunity to be reused and taken advantage of. In this case, the leaves and branches are a residue of agricultural production generated in two of the processes analyzed where, after the collection of the fruits, the raw material will be sold for different post processes depending on who requires it.

But what happens to the elements that accompany the fruit and that do not serve as raw material such as branches and leaves? The main objective of a farmer is to preserve what gives money and in this case it is clearly the fruit, which has been taken care of for weeks or even months leaving in the background the other elements that exist in a cultivation system.

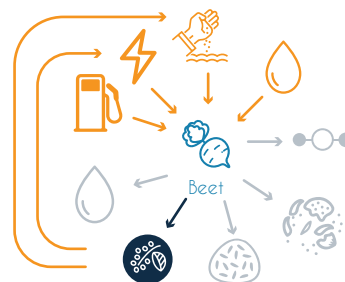
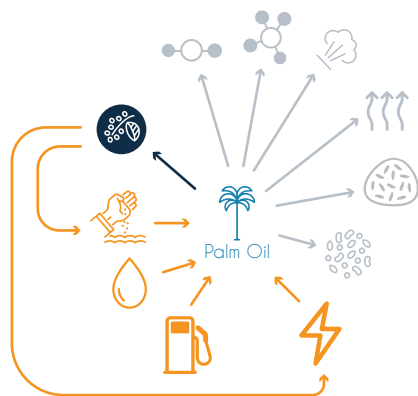
But it should be borne in mind that this output has more potential than just making a pile of waste on the farm since they can work for other sectors resulting in higher profits for farmers, which would eventually transform their thinking to these elements.

If the branches and the leaves are collected, transported and treated in a production plant, they can become the first solution to stop seeing residue as more than a simple hindrance that occupies space in the farms. This solution consists in the crushing of the elements so that they can be placed under a microbiological treatment for a few months, which with the help of good humidity, temperature and oxygenation can become an organic fertilizer, a solution that can be put at the service of the same plantation for the improvement of its soil and the reduction of chemical use.

Another excellent alternative is to crush this output turning it into chips and sawdust to be compacted and form pellets, small pills, ideal for the production of energy in the form of combustion in furnaces and chimneys. This alternative is not only popular because it has a high caloric and combustion power that helps reduce the raw materials required for power generation but also because of the rupture it generates between the oil and gas energy markets, not depending on its commodities and ensuring the stability of its price in the market.



Leaves



Now we will talk about water, an essential element for the development of life on our planet where 70% of its surface is covered by it and of which only 2.5% of the total 100% is sweet. This water is called as suitable for human consumption and 90% of it is stored in Antarctica, leaving a very low percentage of useful water in underground sources, lakes and rivers that should be used for everything on the planet such as food production, energy, guaranteeing the survival of the species and even for economic and productive development, as in the case of Nutella and its ingredients.

The percentage of water mentioned above seems small, but to everyone's surprise it states that "there is enough water to meet the growing needs of the world, but not if we do not radically change the way it is used, handled and shared" (El crecimiento insostenible y la creciente demanda mundial de agua, 2014) . It is here that this residue becomes a real problem and becomes relevant in the analysis of this document.

Currently, agriculture and the washing of the ingredients represent for Ferrero the two major phases of water waste generation. Therefore, for this analysis, we will divide it into two, where we will start talking about the problems caused by the implementation of water in the crops of 5 of the main ingredients of Nutella.

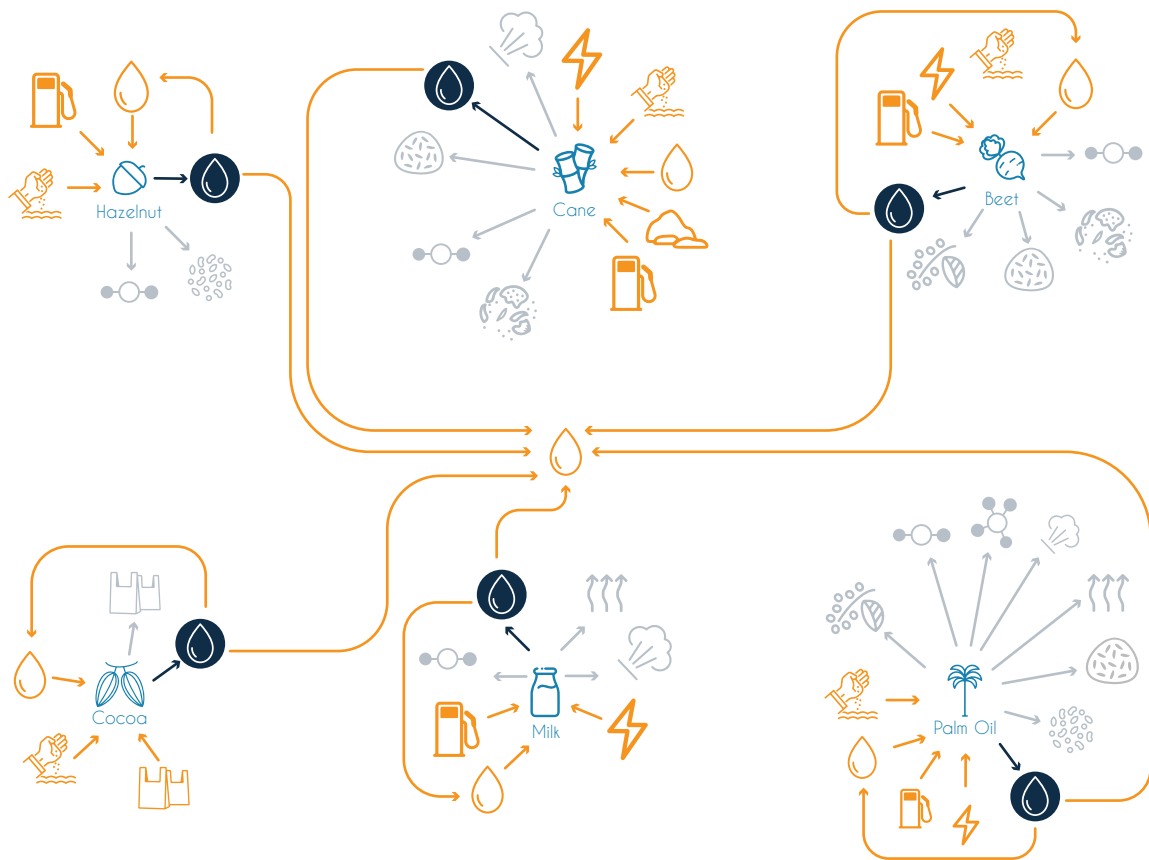
To begin with, we must mention that the greatest waste of water in the world is generated in the cultivation fields due to agricultural processes, a fact that ignites the alarms because in the rural areas more waste is being generated than in the urban areas, a worrying fact not only for the production of huge amounts of wastewater but also these are contaminated with chemicals absorbed during their process due to the use of fertilizers and pesticides, a technique that has become popular after the 50's deteriorating the water status with chemicals that makes it non-potable and deteriorate the quality of soils.

Unfortunately we cannot replace water with any other type of element in these processes since it is a vital ingredient for food production, but what we can do is the implementation of innovative solutions for the return of water in the same system or simply its safe restitution without damaging the ecosystem. To begin this point, we will first propose the union with another of the residues previously analyzed where organic matter such as leaves and branches are converted into organic fertilizers that can be used in the fields to provide nutrients to the soil without the need for chemicals attached, starting to improve the quality of the water that is used. Secondly, it is important that Nutella becomes aware of the purchase and planting of its ingredients, acquiring only in certified places that guarantee the sustainable management of the company and that in general does not make use of intensive crop lands so as not to require the use of chemicals in its soils, which can be replaced with rotation techniques of fields and uses of different plant species that collaborate with each other to reduce the amount of pesticides needed. Finally, filters that absorb any type of impurity that can carry water as chemicals or solid matter must be implemented,

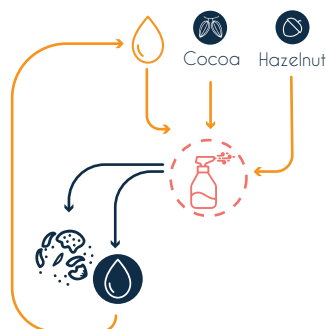


Non-potable

performing a local water processing that reduces the impacts on the ecosystems where this water can subsequently reach.



On the other hand we will see the use of water for washing the ingredients, which is used to remove any impurity that the raw materials that have reached the Nutella plant contain. For this, a plan similar to the previous one must be followed, where water must first be cleaned with nano filters that trap any piece of solids contained in the liquid. Once filtered, the water must pass through a small PTAR (wastewater treatment plant) that must be created inside the factory to process the water in a physical way, where chemicals are not used, returning the water to the practically clean ecosystem or maybe it can be reused within the same company as factories in the world already do, such as Dow in the Netherlands that collects up to 95% of the water used in its plant. This not only leads to a minor impact on the environment but also reduces the need for raw materials that is directly proportional to the cost reduction.

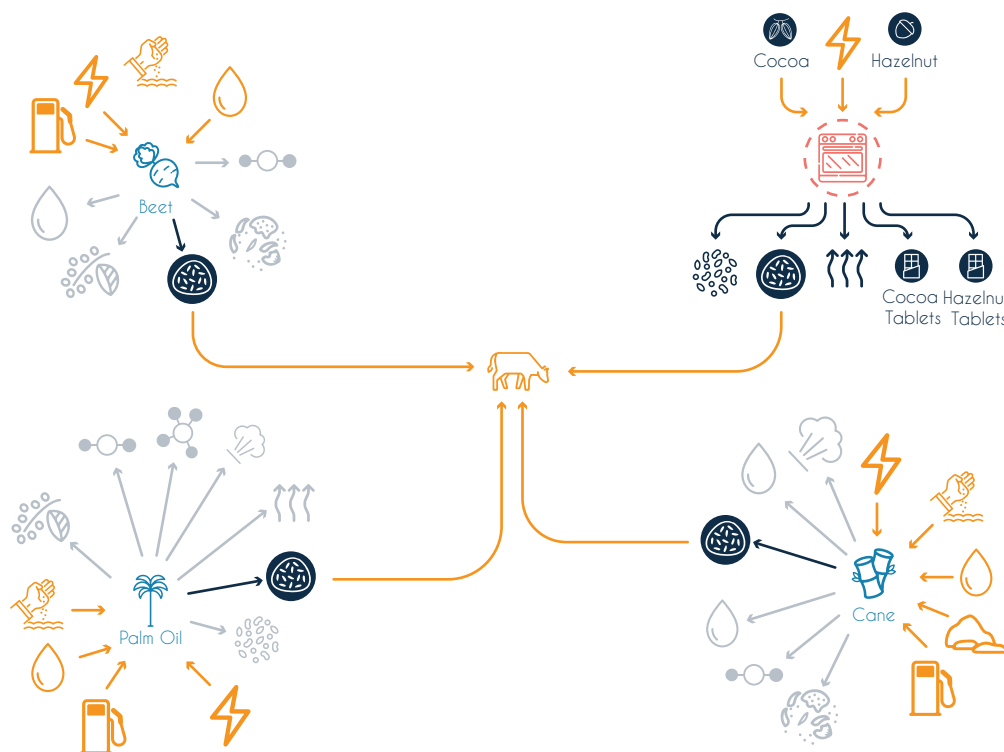




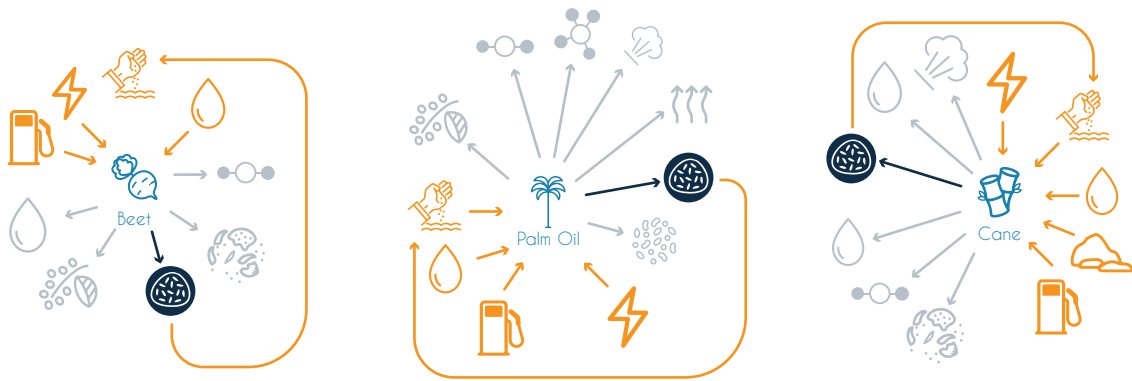
## Fiber

Following the analysis we arrive at the waste called bagasse or better known as fiber that is the leftover of the production process of some ingredients that we analyze in this document where at the end of the extraction of its internal content there is a material waste considered as garbage since it no longer serves for the production of sweet paste because it reaches a point where it loses most of its properties which have been transferred to the mixture. But this does not mean that it is a waste as a whole since it can be implemented as an entry in other systems especially in agricultural sectors.

This organic waste is optimal for the manufacture of products such as supplements for animals, being the simplest solution as it does not require any postprocessing, which means a net profit for Ferrero, who would go from receiving nothing for his waste to some income for them. It must be taken into account that this product is not suitable for all animals, which reduces the target a bit, as they must have a bacterium in its stomach(s), such as ruminants, for the lignin processing found in this product .

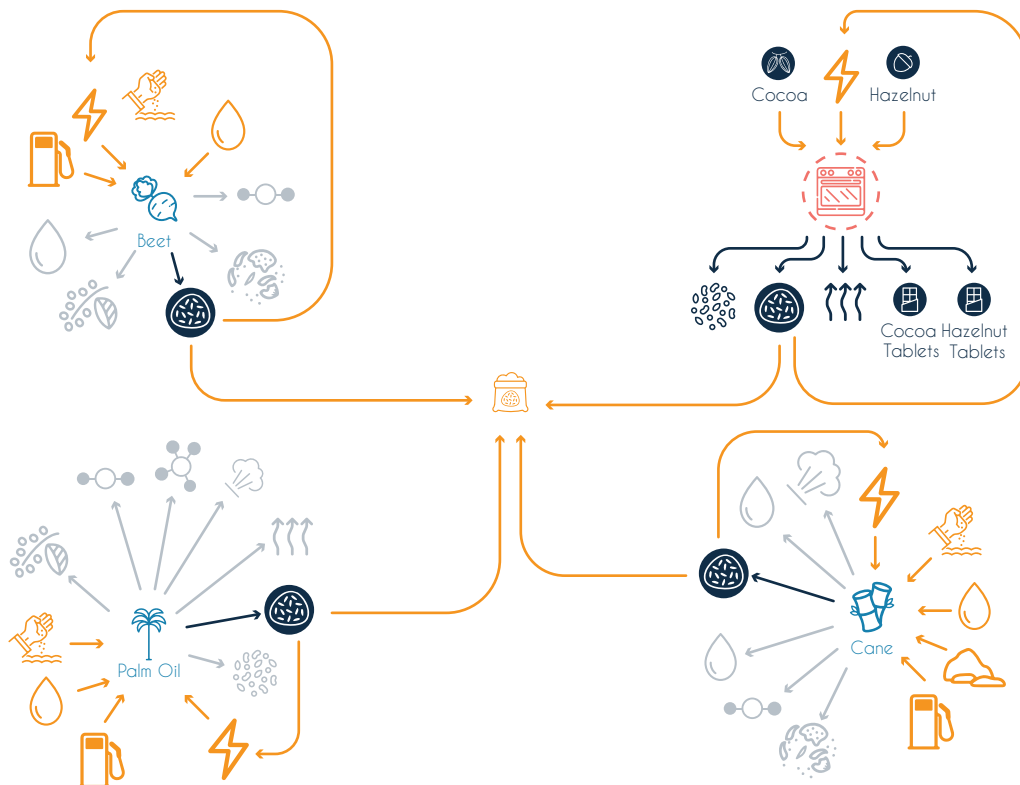


Another solution may be the creation of fertilizers that, like the process of leaf and branch outputs, can create an organic fertilizer, with the difference that in this case a post-processing is required because in the production of sweet paste, most of its sugars have been removed, which results in a negative Ph residue that must be counteracted so as not to damage the soil where it is desired to be applied.



A third option for this output is the use of its dry part from which we can obtain a flour that, when crushed and roasted, preserves the vitamins and nutrients that were not extracted from this output and that will also have the advantage of being low in elements such as sugar being an excellent alternative to make bread or cookies that are directed to demanding markets nowadays as the people who care about each ingredient they consume.

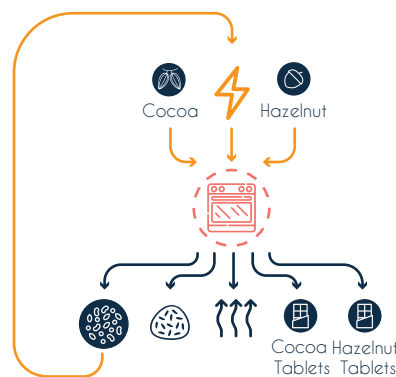
Finally, this output can be used as raw material for power generation where dry matter can be used as combustion material as well as those of leaves and branches.



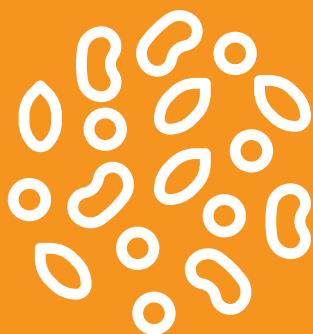
Now we will talk about the shell-shaped residue that is closely related to the previous case since they share similar inmates. These elements are responsible for protecting the interior of the fruit that after drying or roasting processes are detached, which facilitates obtaining the interior but leaving its residue in this case at different stages of the process where the first, hazelnuts, are released in its place of origin, but the second, cocoa, is not released from it until it reaches the Nutella production factory, in this case alba, where this output accumulates.

The husk itself does not represent a danger to the environment since it is still a biodegradable material that disintegrates in the Earth after spending a few weeks in it, becoming an organic fertilizer that does not need any type of post process and provides nutrients to the soil. The real problem of this waste is due to its usual incineration for disposal, since large quantities of this waste are generated as the amount of cocoa processed by the husk generally represents between 10 and 20% of its weight, meaning that tons of this waste can be formed in the production of Nutella, which creates the need to dispose it. This leads us in this analysis to demonstrate that there are more solutions than the indiscriminate burning of this material, which only serves to release CO<sub>2</sub> into the environment and that innovative solutions can come to give Nutella benefits and added values to its products.

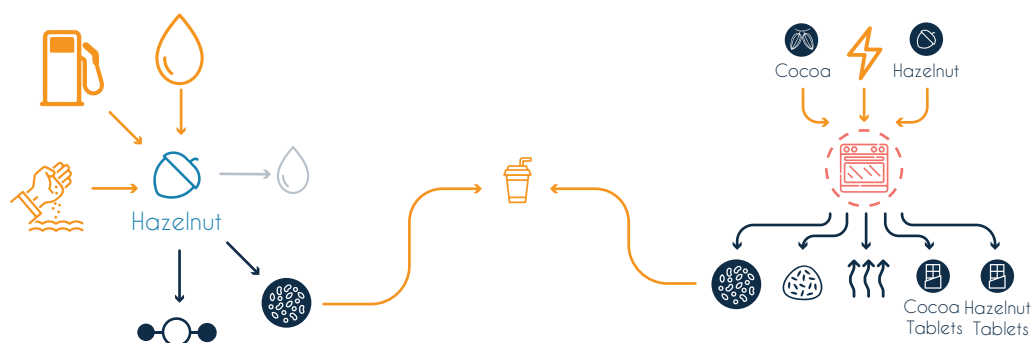
In the first instance we can talk about the simplest solution for this waste that may be the continuation of its burning but this time as a fuel for the combustion of furnaces and chimneys that as a result will also have an exit of CO<sub>2</sub> but that this time at least has a positive impact which is the generation of energy.



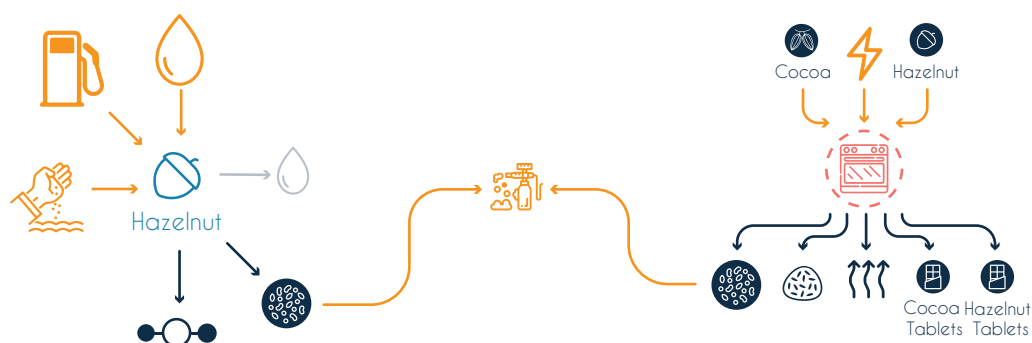
The previous solution is very simple for the current state of the art that is handled today so we will name some other solutions for the generation of products from this as fiber-rich cocoa husk flakes that provide vitamins A and B, calcium and magnesium, among others. Its production is very simple, you just have to extract the moisture from them to take advantage of the dry part of the husks that is equivalent to 93.57%, leaving a very little waste margin. Once the process of drying these is finished, they can be packaged and sold for people who can use them in the field they want as, for example, infusions.



Husk



Another use that can be given to this residue is the creation of foams such as polyurethane, where according to a study published in the journal of the Chemical Society of Mexico, the cocoa husk is used as a complement in the mixture to obtain this product that provides benefits such as increased compression resistance, increased density and greater degradability. In turn, it also helps increase the volume of the foam that reduces its cost by more than 20%. This is an interesting solution to this product that opens the doors to this residue, the polymers, where studies that have experimented for the creation of agglomerates have come out.



Finally we will analyze the packaging of Nutella, a residue that unlike all the above elements, does not work for the sweet dough mix manufacturing, but it does play an important role in the protection of said product. For years the humanity has tried to preserve and protect its food giving rise to packaging, responsible for guarding what the inside contain, earning so much popularity that today 75% of products require it. This generated an increase in the production of waste of all types of materials such as cardboard, wood, fabric, among others depending on the objective with which it was designed, in the case of Nutella plastic and glass are used, which are added to the list of waste generated by packaging where these represent 3% of the 39,000,000 tons of solid waste generated per year by humans. For this huge amount, this output becomes an important sample for the document that regardless of its nature and change in the line of what was being handled should be considered in this analysis.



Ferrero currently produces more than 70 million containers a year, as mentioned in the second chapter of the document, produced from non-renewable materials such as oil and silica that although not renewable at least has an abundant presence on the Earth surface. Once these materials enter the production plants, they are provided with the property of plasticity from the investment of large amounts of energy in the form of heat, which in turn generates and releases important amounts of gases such as CO<sub>2</sub>. This is already a big problem but unfortunately this does not end here and the problem of packaging is asserted by its endurance in the environment, taking too long to get its biodegradation where the plastic, in this case PHDE, will take approximately one thousand years and the glass about 3000.

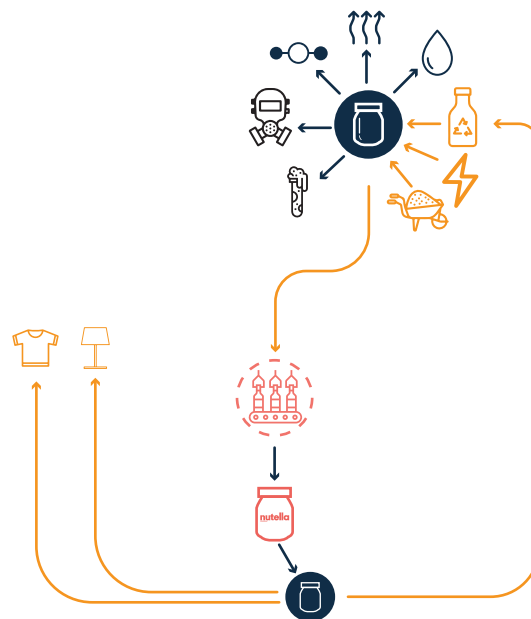
Regardless, these materials are one of the most used in the market today where plastic for example is the material that covers 54% of food packaging, which has led to the development of the industry for the production of these where it would be expected that also the techniques for its disuse and recycling were at the same height, but unfortunately it has an inversely proportional effect where the state of the art for its post use is very basic as we will see below.

Currently, plastic and glass can be recycled with certain obstacles and differences starting with the first one, respectively, which can only be reused up to 5 times so as not to lose its properties so that a product made of 100% of it cannot be produced since you should always apply a mixture that does not exceed 30% in its content so that the same thing mentioned above does not happen and the product does not lose its quality.

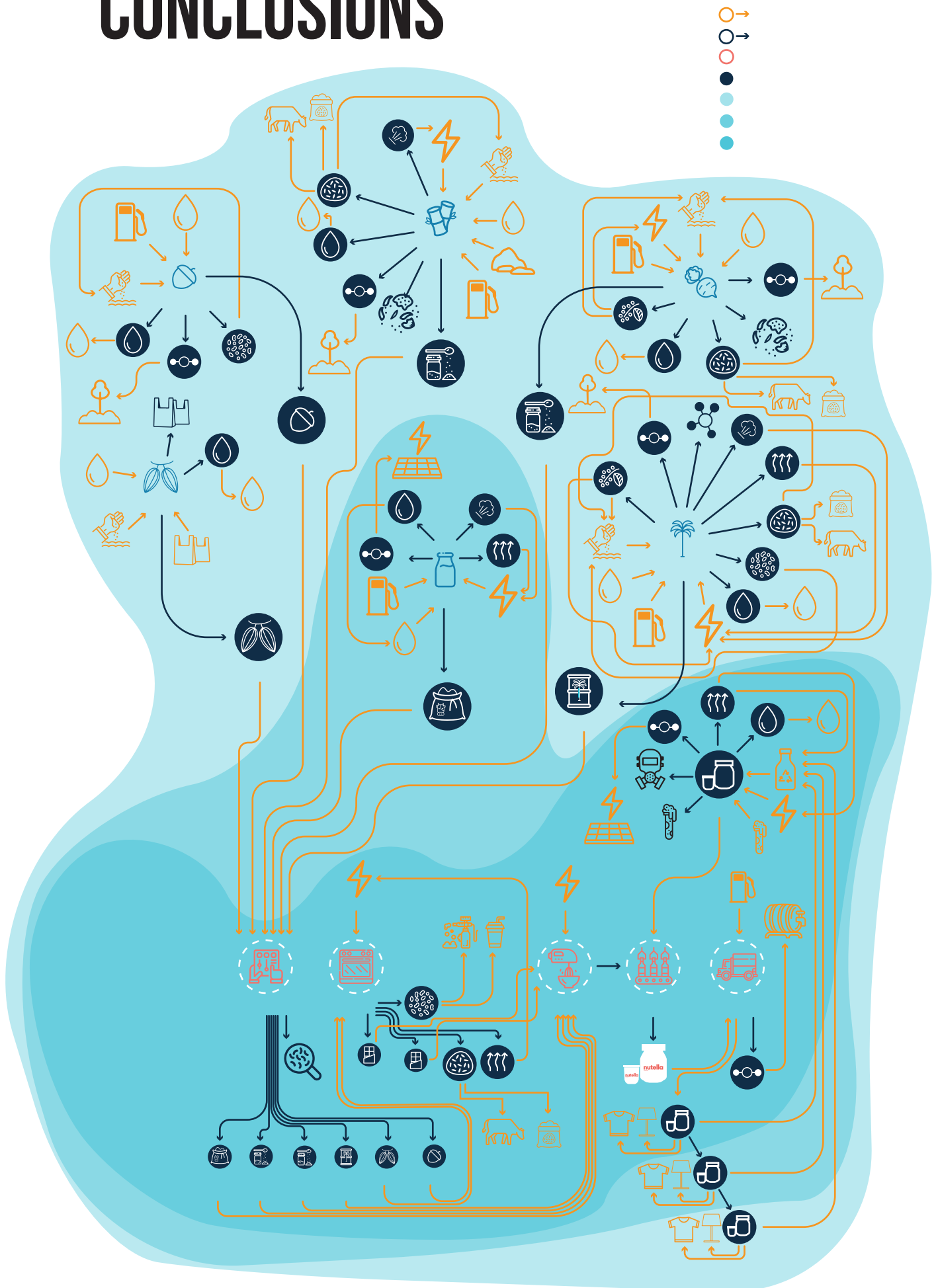
On the other hand we have glass, a 100% recyclable material and that

can be incorporated as many times as you want in any mix for the creation of new products as long as it has been classified and separated by colors as Germany does, otherwise a brown glass will be obtained as the characteristic color of beer bottles. With this recycling process, the amount of energy required for the production of new objects can be reduced up to 40%, but it should also be mentioned that the energy required for the production of glass compared to plastic is much higher, so If you want to make the glass a worthy plastic container, you must use each product that is acquired from this material a minimum of 3 times before disposal, putting the single-use products in check.

Nowadays people start to react to this problem by reusing their glass containers as seamstresses, jars for jam or even for the manufacture of lamps. On the other hand we see that plastic also starts initiatives such as the case of puma that creates threads from PET containers that will be used for the creation of clothing for its brand and although all this sounds interesting they are step solutions since they do not close the system and in the end they will fall back into the hands of natural processes, taking more than 1000 years to get destroyed.

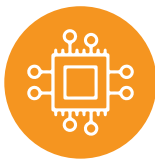


# CONCLUSIONS



To begin this chapter we have made a new map where we can see the recent links created for the Nutella production system where 82% of the outputs, over 100% of those identified, have a new connection that makes them an recycled entry for internal or external use of the company. But it must be taken into account that not all recycled inputs generate the same impact on the system, which now leads us to the implementation of a quantification tool known as a radar or spider diagram useful for visual identification of the current performance compared with the ideal.

To start, we must evaluate the 8 types of residue analyzed in the document regarding their proposed new solutions taking into account the following 10 parameters:



The solution is considered technologically advanced and is at the level of current market offers.



Reinforcement for the reduction of raw materials required in the Nutella production process



The amount of raw material required for the development of the new connection is low.



Scalability and repetition of the process in other systems.



Once the connection is established, the ideal is the low generation of new waste.



It presents a low complexity in the waste reuse process.



Recycled output brand improves perception.



The new connection increases the company's profits.



A loop effect is created with the new connection.



The solution adds value to the product.

The scores will be represented in each radius of the circle, in which the maximum will be five and will be located in the outer circumference of the diagram. On the other hand, the lowest grade will be directly proportional to the proximity of the inner circle of the diagram where the evaluation will decrease respect to the distance with it, until reaching one which is the minimum grade.

Once qualified, the scores thrown will be computed to evaluate and determine which of the solutions satisfactorily fulfills its new purpose. This means that if the final result of the sum is less than 30, this solution will be taken into consideration for the continuation of the document since it does not comply with what is sought and probably has greater potential in other fields.

Having clarified this, we will start with the diagrams in the same order as in chapter three where we will go from steam to the containers.



The score obtained in this category is 36, which means that it passes the cut and is considered as an approved solution. In its qualification several parameters can be observed with a score of 4 corresponding to the cutting-edge technology used, which helps to optimize waste by bringing benefits to the company not only economic but also of reduction of raw material necessary for some of the productive process steps, with a very low addition of new raw material which means a reduction of the impact produced by the company which is not very visible to the outside world so it does not positively affect the perceived image of it or its product.



## Released Heat

The score obtained in the second case is 37, a point higher than the previous one which consequently means that it also passes the cut and is considered as an approved solution. In this case, the technology used is the most modern in the market due to the complexity of waste collection and reuse, where its recycling process will not require any new raw material, but as a result leaves a low amount of usable product, representing an aid to the loop type closure, but not much to the reduction of materials currently required in the production process. Like the previous one, this solution is not very visible outside the company, so it does not positively affect its perceived image or the image of the product.



## Co<sub>2</sub>

The score for this category is somewhat lower, but it still passes the cut and is considered approved. For this waste, high technology is needed for reuse, the recycling of the product cannot be carried out within the company, its establishment as a process is complex and the loop type productive model cannot be guaranteed. On the other hand it has high qualification in parameters that raise the evaluation such as the increase in the value of the brand perceived by consumers since this issue is sensitive and popular today among buyers, who will value each contribution against producing this residue



## Leaves

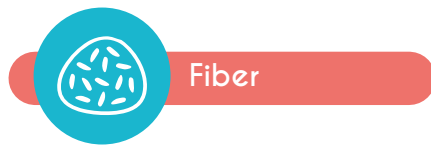
The leaves are one of the most complete waste since it has a high and very even score, 38 over 50, passing the cut with a

good margin and being classified as approved. This solution can not only give profits to the company, but it is also one that best manages the production loop type model, producing a low amount of waste, especially if it is used as a fertilizer since it reduces the need for some raw materials for the production phase of the ingredients. This does not require high technology because it is easy to produce, but like other categories, this solution is not very visible outside the company, so it does not positively affect the perceived image of it or its product.



### Non-potable

Water is the best qualified proposal in these diagrams and although its current situation represents a risk for our planet with the proposed solution it achieves a score of 41 that gives it the approval. To be able to treat the water and return it in a perfect state to the ecosystem, a technology with a certain degree of complexity is needed but it manages to close the loop cycle without the need of many new raw materials to do it and although they have waste, residue which the water already contained, these can be easily stored and disposed of in a safe way, helping the company with its image perceived by consumers due to the importance of conserving this element.



### Fiber

Now we will talk about fiber, a category that receives a rating of 36 and therefore approved as a solution. This is a versatile resin that serves several uses where depending on it, the production process can be more or less complex. It usually moves in a medium range, where the addition of raw materials for its new use is usual and, at the end of this, the process does not end up greatly reducing the demand for raw mate-



rials required for Nutella production. Apart from this, this solution becomes a product that gives a monetary input to the company and a scalable model for other industries that handle the same waste.



Due to the 29 that this category receives, we see for the first time a negative result in this analysis, meaning that the idea has failed to pass the cut and one must think of a new more comprehensive solution that helps in the search for the systemic process. This qualification starts badly from the generation of new waste such as CO<sub>2</sub> and from the basic technology used for its treatment since currently there are much more powerful tools in the markets that can be used to make better use of the waste, taking advantage all of its potential, which should be given more attention since it makes a strong presence in various industry processes, an opportunity that could become an easy scalable model, where if you think otherwise it could help reduce the necessary raw materials for the company or at least the production of some extra income for it.



To finish with the qualification of the new connections, we have the worst qualified solution, with a 28 that, like the previous one, must be reconsidered to seek the development of the systemic system. Although this alternative begins with a high score in the aspect of the improvement of the image of the company and the product, due to the great ecological current movement that looks for the reduction of pollution generated by these elements, it is quickly overshadowed by the low implementation of innovation applied to this waste, developing at a standard technological level where its treatment generates significant amounts of new waste and in turn requires new raw material for its modification, which will not help to close the loop cycle.



# PROPOSAL

In the previous chapter, the cocoa husk and the Nutella container did not obtain the qualification required to be considered approved, where most of the proposals were formulated for an external use of the factory. For this reason, in this new section we will examine the aforementioned waste to give them a new connection, which if we look at internal use, there will be new possibilities for the company with which they have not experimented, proposing a new outcome with the help of current technologies and future ones that reinforce the concept of systemic system that we look for in the document and improve their qualification.

We will begin this new analysis from the Nutella containers, cataloged as a single-use container, an element that loses all its functionalities and is discarded once what is kept inside is consumed, generating large amounts of waste per year. that means a risk for the sustainability of the planet since millions of units are sold every year on a local and international scale.

But then what can we do with this residue apart from what is currently proposed? Nutella has already entered this research and that is why he has created campaigns and competitions where for example he has worked hand in hand with universities such as the Polytechnic of Milan to transform the Pelikan, Nutella container, into new products that extend his life after the consumption of the sweet paste found in it. From this contest called Hack the Icon, proposals such as scales, lamps or even chandeliers emerged (as can be seen in the images presented below) that unfortunately did not transcend beyond the paper since no matter how much it helps with the reuse of the containers they generate a loss in the perceived value of the brand and its packaging which did not interest Ferrero.

*Graph 12*



*Hack the icon projects. Retrieved from <https://www.nutella.com/it/it/hackathon-nutella>*

This is why Nutella decides to speak with large companies such as Alessi to propose new solutions but this time without a loss of perceived value, which gives rise to Nutella Clock, a Ferrero campaign that reached several supermarkets in Italy with the aim of reusing Pelikan, where for the purchase of two large Nutella preparations, an accessory was delivered that replaced the product lid and fit on the top of the container, making this residue an ideal accessory for decorating spaces such as homes or offices. But although this solution at a visual level is good and was well

received by the public, there is still a gap in it regarding the speech of what Nutella wants to sell, a sweet paste that accompanies breakfast for family enjoyment, so these alternatives may no longer result in the loss of perceived value but in the loss of coherence of the brand's objectives.

Due to the separation of the culinary discourse evidenced in the recently commented example, I bring the latest example for the reuse of Nutella containers, this time from the hand of the agreement between Ferrero and Mr Smith Studio which creates a new version of the Pelikan based on a minimalist, elegant and clean design where the label is no longer necessary because it is replaced with an embossing on the glass and where the opening of the mouth of the container is modified to be compatible with conventional canned lids on the market, so that once the sweet pasta in the canister is finished, it can become a container for storing other foods such as marmalade.

Graph 13



Pelikan. Retrieved from <https://packmedia.network/en/content/best-packaging-2017-technology-meets-design>

Graph 14



Silos. Retrieved from <http://www.mrsmith.it/work/silos>

But although of the last three proposals this is the most comprehensive among them, because it has the least loss of perceived value and at least is linked to the culinary issue, it is not entirely satisfactory since it is not directly related to the brand, generating a new void in the product which also continues to have a high probability of disposal after a couple of reuses, that is why we will continue to enter the Nutella company to see how we can solve these dissidents that are presented in the subject.

To respond to the differences originated in the previous proposals, which seek the development of the integral design of the Nutella packaging, we must first decide which of all the presentations we will choose to work (graph 2 to 4) where the 15g and 200g confections stand out. The first one, mentioned above, stands out because it moves away from the study line of this analysis, since it is composed of materials that are not mentioned before in this document, such as polystyrene and composite materials, which are difficult to recycle and biodegrade, creating a great impact on our ecosystems that is even more aggravated by understanding the classification of this presentation as a single-dose product, which means that it contains a small amount of sweet paste ideal for the consumption of a single person, but that it is not as perfect for the environment as it results in greater waste due to its ephemeral use time compared to the other apparels that this company has. This makes this article a worthy piece to consider in the development of this work, of which we will not analyze its pros or cons but we will eliminate it directly from the range of presentations that

Ferrero handles, due to its high impact. We will also cross the information we can obtain from this with the previous research to find a solution to the waste analyzed in Chapter 4 and propose a new connection.

Graph 15



Nutella 15g. Retrieved from <https://www.thebathbushcraftshop.com/products/nutella-15g-chocolate-spread-portion>

On the other hand we also see the 200g packaging of Nutella interesting since it does not present the famous shape of the Pelikan, due to a recent design called Silos created by the design studio Mr Smith Studio. The intervention and the creation of this Nutella presentation is a balance between all the presentations of the range offered by Ferrero since it does not have a use as ephemeral or as prolonged as the presentations of 15g or 900g respectively, being an ideal product to satisfy cravings of consumers who today care more about what they eat and where they grow concerns about healthy eating, an issue where Nutella is seen as harmful to health due to the ingredients it contains such as sugar.

Graph 16



Nutella 15g. Retrieved from <http://www.mrsmith.it/work/capsula-in-carta>

Ferrero always worried about the opinion of his consumers has taken actions against the bad comments towards his company, which affect the image of it as the case of the use of palm oil, where they have implemented actions against deforestation and have made agreements with organizations like Greenpeace that certify their good management of the lands and therefore guarantee their products, improving the image perceived by the public. Now with the theme of good food comes the ingenious Silos container, which tries to solve these concerns from the design of its shape, since its goal was to create a container that was not so large and that psychologically was not so shocking when interacting with the candy market, making this product ideal for sale in the market, especially for children, where mothers can control the amount that is supplied to their children and also will not last as long

on the shelves as other manufacture of the brand. But the most attractive feature of this presentation was the proposed design so that the packaging was not discarded directly after its main use and could be used as a glass for the drinks that accompany breakfast, as a container to take the measures in the realization of some recipe or any other use that the imagination proposes, as being a toothbrush holder for the bathroom. For these reasons it is that today this confection has gained so much popularity and ground in the markets, where today more than 8 million a year are sold.

But this also opens the window to new criticism, where the packaging was thought to be reused, leaving aside the forgotten fact that it does not replace the need to buy new packages to supply the product stock in the homes of the world, which means that the amount of time of use of this container as a guardian of Nutella has been reduced. This generates greater accumulation, so that when it reaches a considerable repetition of these in the houses, it results in its disposal as before. On the other hand we must also highlight the good work that this packaging has done as a marketing strategy, but that finally falls short and fails to solve the real difficulty of being seen as a product harmful to health, a problem that is not new to Ferrero, where in 1968 the company confronts it with the change of his recipe, emerging kinder Bars, a somewhat extremist solution nowadays since this product is not at all bad for the health in the diet of an average person, who consumes 2000 Kcal per day, where you can eat up to 25g of this sweet paste per day. This shows that this package still has things to solve and that it can be another great clue to the continuation of this document.

Finally, before we leave the issue of packaging, we want to bring to the document the analysis of Nutella's advertising throughout history, where we can perhaps see user relationships with the product, suggesting the principles and objectives of the brand, which can provide clues for the renewal of its packaging.

Graph 17



Retrieved from <http://nutella-tpe.e-monsite.com/pages/page-3.html>

Graph 18



Retrieved from [https://cincodias.elpais.com/cincodias/2014/07/22/sentidos/1406055954\\_937834.html](https://cincodias.elpais.com/cincodias/2014/07/22/sentidos/1406055954_937834.html)

Graph 19



Retrieved from <https://netnews.com.ar/nota/2188-Nutella-anuncia-su-relanzamiento>

The main target of the brand when it was born were the housewives and especially, as its poster says, the smart ones (figure number 11) where women are shown running to take the Supercrema container because they see how in a simple way a girl stops playing to eat what the mother has prepared, something that only this sweet paste could achieve.

Subsequently, this product changed its name but not its objective and continued to target housewives with a small extra that was the explanation of the perfect time to eat Nutella, breakfast. A crucial moment for the feeding of children where this sweet paste offered the "healthiest ration that nature could offer" as seen in the graph number 12 and that it was so easy to prepare that everyone could spend a family moment and enjoy where also the cook would not move a hair from her head.

Today this product continues with the same goal although now the housewife roll is not so marked where currently any parent can take care of providing this great food for their children, arriving at each table in the world to make breakfast a special, delicious and practical moment.

But among this great breakfast that we can see in the graph number 13, where everything is perfectly placed so that several members can eat makes us ask ourselves, is the average breakfast really like that nowadays? How much time do average families have for breakfast during the week?

With these questions we can identify another problem where Nutella, the perfect breakfast product, ideal for people between 1 and 65 years old, who sees as a target parents concerned with feeding their children and children as persuaders for buying this product, does not transcend and is left alone in this, forgetting that times have changed and that they have not adapted to it. Today the average person have only 67 minutes to eat the three big meals of the day, which means that if we divide it, we will only have approximately 22 minutes to devote to each meal, adequate time for breakfast if we do not think in the fact that it must be prepared, forgetting that parents should also prepare their children's breakfast, leaving little or no time at all for their own breakfast, having to find solutions to take it in the day. This leads us to reevaluate the target of this brand to find a new one, opening its market to parents who have hard working hours and have very little time left for the consumption of their own breakfast and taking into account that not anywhere is optimal to do it.

*Graph 20*



Having an idea of what can happen and what we should do with the Nutella containers, let's talk about what can happen with the cocoa husk, a byproduct that some researchers analyze today discovering that "it has great qualities such as good absorption and retention of water, a high content of OH present in lignin (32%) and cellulose (17%) that contains this residue and it is highly biodegradable", which gives it interesting exits in the current market apart from being a fertilizer or food for animals, where one of the most promising is the creation of foam based on a hybrid mixture between husk and polyurethane resulting in the creation of a polymer that can be used in different fields. This alternative is mentioned in the previous chapter but it is mentioned again because the characteristics that it presents makes it ideal for experimentation, which now brings us to talk about agglomerated materials, also a hybrid mixture that can be made with any plastic and shell of cocoa creating new materials as in the case of the study conducted by Andrea Katherine Chacón Romero for the Piloto University of Colombia in the engineering faculty where tests were conducted with various mixtures in different concentrations of cocoa husk which changes its physical properties depending on this, getting as a result that the maximum optimal mixture is 50% of husk and 50% of the plastic so as not to lose all the

properties that the plastic offers to the mixture. With this experiment it was possible to identify that with the addition of this material, greater resistance to bending is obtained and a lower compression resistance is obtained, characteristics that we could evaluate for their use within the Nutella package.

Graph 21

Prueba de Flexión						
Aglomerado de Bolsa Plástica reciclada y cascarilla de cacao						
Muestra	% de Bolsa	% de Cascarilla	Avance inicial (mm)	Fuerza Final (N)	Deformación (mm)	$\sigma$ (N/mm <sup>2</sup> )
A	50%	50%	84,94	13	3,88	2,34
B	70%	30%	86,57	48	14,92	12,0

Chacón, A. (2013). Desarrollo de aglomerado a base de residuo orgánico de cascarilla de cacao y bolsas plásticas recicladas.

Graph 22

Prueba de compresión							
Aglomerado de Bolsa Plástica reciclada y cascarilla de cacao							
Muestra	% de Bolsa	% de Cascarilla	Avance inicial (mm)	Fuerza Final (N)	Deformación (mm)	Área (M <sup>2</sup> )	Esfuerzo (N/M <sup>2</sup> )
A	50%	50%	99,71	237	3,11	0,283	839
B	70%	30%	93,29	184	1,95	0,3	720

Chacón, A. (2013). Desarrollo de aglomerado a base de residuo orgánico de cascarilla de cacao y bolsas plásticas recicladas.

properties that the plastic offers to the mixture. With this experiment it was possible to identify that with the addition of this material, greater resistance to bending is obtained and a lower compression resistance is obtained, characteristics that we could evaluate for their use within the Nutella package.

Once the scope and current problems of these materials are exposed, we will begin the development phase of the final proposal for this document that improves the connections of the exits and creates a systemic model for the production of Nutella that will be based on all the requirements obtained throughout this analysis. For this we will begin with the explanation of what will happen with the presentation of 15g that was removed from the range of Ferrero products, which needs a substitute.

Currently in the market there are better responses in the design of single-dose packaging where we will see as an example the pods, capsules of materials usually based on polymers or aluminum that contain an individual dose for the consumer which helps to preserve the characteristics of the product such as freshness since it is not open until its consumption, being a fast, comfortable and precise sequence of use since it gives the recommended quantity of the product. Today this technique has become so popular that it is becoming a serious problem for planet Earth because according to Halo, manufacturer of biodegradable packaging, more than 13,500 capsules per minute are discarded in the world, which means that more than 7 thousand millions of these are thrown a year. But then why do we take this as an example? The answer is simple and is due to its use, which as stated above is very simple and practical, a quality that we seek for this project. And what happens then with the waste? This problem can now be easily solved since the current market proposes the elaboration of this product from other more environmentally friendly materials.

With this information we welcome you to the first part of the solution of this analysis and also to the new product that will be part of the Ferrero family, Nutella Pods, a product inspired by coffee capsules and detergent materials, which dissolve after use, resulting

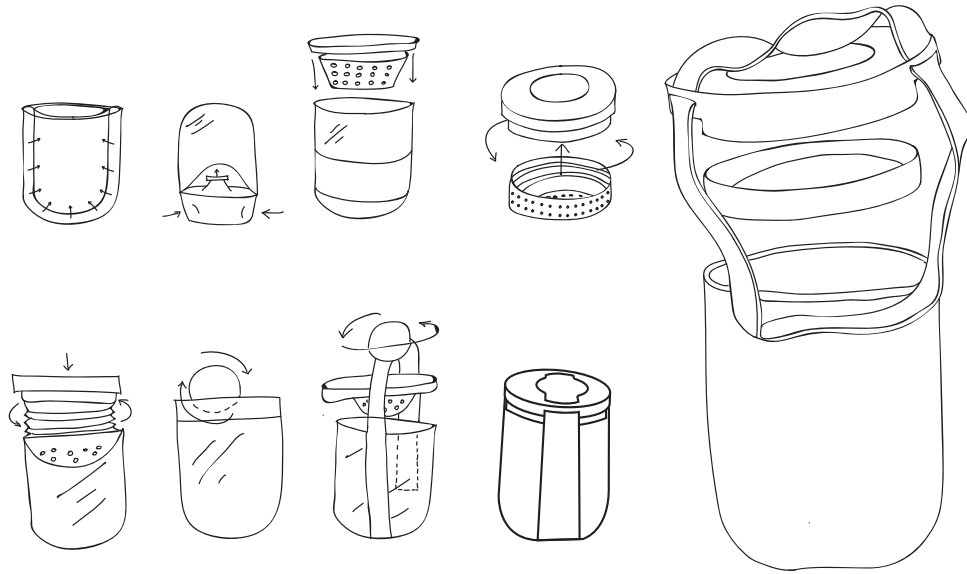
in a capsule with a net content of 15 to 20g of Nutella that will be provisionally protected, while edible and biodegradable materials based on algae are being tested, by the Mater-Bi, a Bioplastic suitable for the use in the food sector where some products are already made for them as cutlery, plates and bags that biodegrade in less than a year.

Graph 23



Like any new product this will need a marketing strategy that helps its incorporation and acceptance in the market, so it will make use of the two residues, the container and the cocoa shell, where the first respectively mentioned will not suffer changes on its texture, color, size or shape but it will in the way of use, where the purpose for the packaging will no longer be left to the imagination of the users but will now be understood exclusively as a lunch box. This idea is born due to the current need where parents do not have the necessary time to have breakfast, so we will provide them with a tool to make these mornings easier, since with the packaging they can enjoy their breakfast at the time and place they want, a concept similar to that of Nutella and Go with the difference that with this lunch box you will have greater flexibility with respect to what will be inside because it will depend solely on the user, because as Michelle Ferrero said, Nutella can be combined with any ingredient such as fruits or vegetables, among others, creating an infinity of combinations where the limit will be only the imagination. We must also bear in mind that if we want this new proposal to work we will have to eliminate the preparation of 200g from the markets, so that the Silos does not become only a gadget that is accumulated in our homes and that is discarded when there are already several of them. This means the suspension of its production since the project will only work with the units currently produced, turning them into collectible items that add value to the product, being this our second marketing strategy.

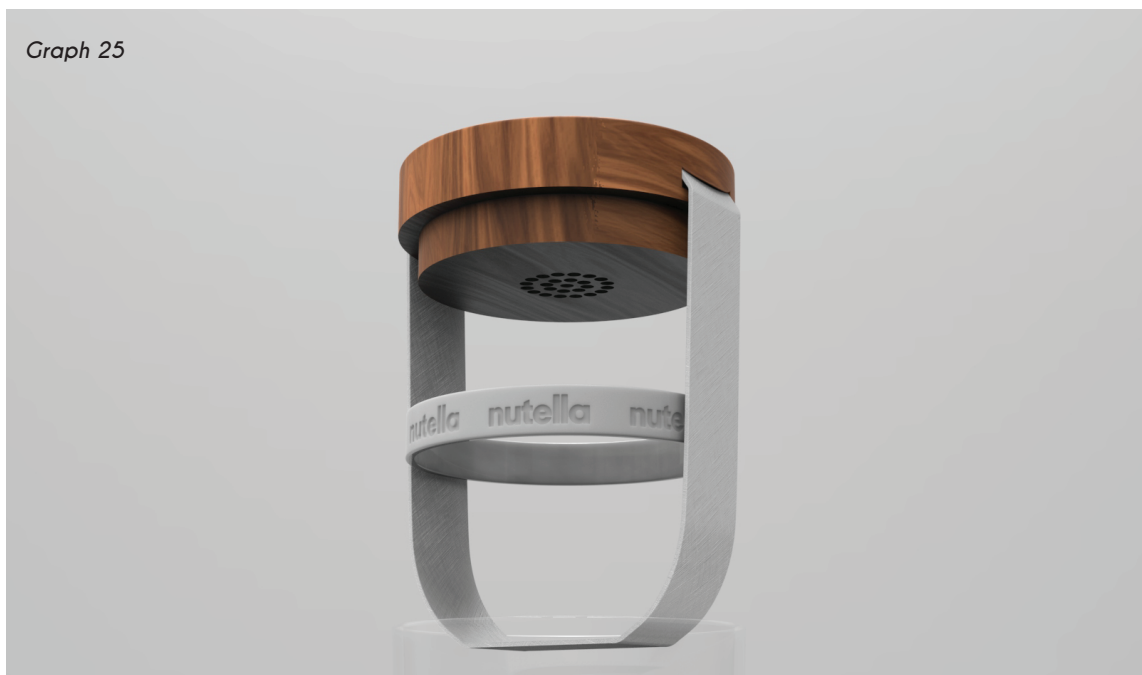
Graph 24



But this new solution still needs something to work, for which a design work is undertaken, where after several sketches and attempts, as can be seen in graph number 15, the heart of this new proposal is born where the cocoa husk and the third marketing strategy will enter at stake. This object is a new accessory for the container that will replace the conventional lids of the packaging by connecting and agglutinating all the proposals previously presented in the analysis, being responsible not only for keeping every element contained inside the package, creating an hermetic closure, but also for supplying Nutella to the content

This new accessory will be composed of two elements where the main body will be the central body created from a 50% cocoa husk agglomerate and 50% recycled plastic from the current Nutella confection caps, which will be collected from the incentive to consumers where for the delivery of a certain amount of lids at the nearest store they will be granted a discount on the purchase of their new lunch box called Nutella Click. These caps will be returned to the factory where they will be melted and combined with the cocoa residue to create a new plastic material that will be introduced into molds to give it the desired shape.

Graph 25



The second element will be an elastic band created out of silicone that in addition to giving the product an aesthetic touch, it will also help to give firmness in the closure at the central body and also to the explosion of the Nutella capsule that will be given in the chamber of the central body, being a fast, practical and clean process where not much space or external elements are required.

Graph 26



adjust  
the silicone band  
which secures the  
lid and helps to  
seal the jar

Graph 27



Pull the band a little  
up and introduce  
the pod into the  
cavity

Graph 28



Put what you  
want in, adjust  
the band and  
take it with you

Graph 29



adjust the band  
and with your fingers  
press on the top  
center to break the  
pod and give the  
magic to your  
breakfast

*Graph 30*





By combining the jar residue with the cocoa husk, a part of the Nutella production cycle is closed, creating a new output that receives a rating of 42, which means not only that now they are approved with respect to the rating table, but also they become the best qualified waste of the entire analysis

The evaluation received reflects an increase in the vast majority of the aspects qualified in the diagram where categories such as technology now represent the implementation of advanced models with respect to those offered in the current market, where it is not necessary for its process the addition of any new element since they are already within the same system.

On the other hand we can see categories such as the generation of new waste where the qualification of this new alternative is affected a little because of the fact that when a part of this new product arrives at the end of its useful life it cannot be recycled because its interior has the same characteristics as plastic, but at least this time it is in a smaller quantity and with a different composition that helps its biodegradation to happen in a shorter time.

Finally, we have the economic part which is positively affected because it is a profitable intervention for the company since when handling waste that represents a current problem for the sustainability of our planet, it creates an increase in the empathy with buyers looking for products of this genre, adding more value to the product and perception on the company, translated into profits. It should be noted that in this new process Ferrero will become a pioneer company and a role model, but which not all companies will be able to imitate since they must present characteristics very similar to those that Ferrero has, lowering their possibility of scalability.



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