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“Proposal for an Environmental Management System to dairy artisanal
industries based on ISO 14001:2015”

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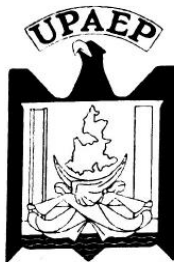
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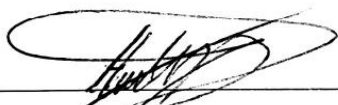
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“Proposal for an Environmental Management System to dairy artisanal
industries based on ISO 14001:2015”

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Dedicated to

I dedicate my work to my example of life, to my guides and help all the time, to God and my parents who love me, seek my well-being and always advise me to find be better.

To my brothers, who are my pillars, my joy and my support.

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Abstract

The research addresses the environmental pollution as the main issue, focusing on the elaboration of a functional environmental management proposal for small and medium-sized dairy companies in Olancho, Honduras, due to the fact that, according to previous research, small companies in this region do not count with the necessary methodologies and tools to improve and reduce the environmental impact caused by the large percentage of waste resulting from the cheese manufacturing process (whey, liquids) which are discharged into rivers, lakes and land without any previous treatment. For this, the design of an environmental management proposal based on the ISO 14001: 2015 standard is presented, which is expected to generate greater profitability, recognition and environmental benefits such as the reduction of whey in nearby rivers. The research presents a previous analysis, the methodology, for which a diagnosis was made about the environmental situation and conditions of the artisanal dairy process in Honduras, taking as input the information collected methodologies were established and the development of a training program. At the end the discussion, recommendations and conclusions are presented.

Resumen

La investigación aborda como tema principal la contaminación medioambiental, centrándose en la elaboración de una propuesta de gestión ambiental funcional para las pequeñas y medianas empresas de lácteos en Olancho, Honduras, debido a que de acuerdo con previas investigaciones las pequeñas empresas en esta región no cuentan con las metodologías y herramientas necesarias para mejorar y reducir el impacto ambiental provocado por el gran porcentaje de desechos resultantes del proceso de fabricación de quesos (lactosuero, líquidos) los cuales son descargados en ríos, lagos y tierra sin ningún tratamiento previo. Para ello se presenta el diseño de una propuesta de gestión ambiental basada en la norma ISO 14001:2015, la cual se espera pueda generar una mayor rentabilidad, reconocimiento y beneficios ambientales tales como la reducción de suero lácteo en los ríos cercanos. La investigación presenta un previo análisis, la metodología, para la cual se realizó un diagnóstico sobre la situación ambiental y condiciones del proceso artesanal de lácteos en Honduras, tomando como insumo la información recolectada se establecieron las metodologías y se planteó el desarrollo de un plan de entrenamiento, al final se presenta la discusión, recomendaciones y conclusiones.

Introduction

The planet earth has been the home of human beings since its existence, unfortunately, the natural resources have been contaminated by the footprint of the human in search of their development, despite it represent the main sources of energy and human health. Large industries have produced the pollution of soils, resulting in the lack of crops that can be consumed as a food supply. The pollution is increasing due to the population has grown considerably and its footprint has marked each natural resource, which has caused the saturation of pollution on the planet earth, the emergence of new diseases and the loss of their habitat.

Although many organizations worldwide have implemented strategic actions to deal with this problem, small and medium industries has a lack of methodological tools that can be implemented with a low amount of investment; such is the case of the dairy industry, which is one of the biggest water pollutants in the world, estimating that by 40,000 liters produced daily, generate pollution of 1,250,000 inhabitants (Valencia & Ramírez, 2009). This industry it is characterized for the absence of activities dedicated to preserve the quality of natural resources, and therefore the accumulation of waste, as the whey generated by the process discharged in the soil, air and water.

As (Mahajan, 2008) argued, the waste management should be considered as important as the process itself and all people concerned with research, processing, project, design and off-site facility should look at the problem from the beginning of the process. Due to this, the document will present the development of an environmental management proposal based on the ISO 14001: 2015 standard with the objective of finding alternative solutions that allow improving the environmental conditions through the identification of impacts in the environment and the implementation of corrective actions and preventive.

The proposal was elaborated based on the environmental conditions gathered from the general analysis of the small and medium dairy industries of Olancho, Honduras, focusing on the artisanal cheese process; since according to previous researches this one generates the whey by-product, considered as the biggest pollutant in the industry. The proposal is

structured in a methodological way, presenting the activities and tools that should be carried out in each of the phases documented in ISO 14001: 2015 (Context of the organization, Leadership, Planning, Support, Operation, Performance development and Continuous improvement), in order to get the control of environmental impacts and the implementation of strategies aimed at cleaner practices.

The environmental management proposal develops a general methodology to allow all small and medium industries can put it into practice the activities and templates that can be used. The proposal aims to improve the physical, environmental, and operational condition of the industry, emphasizing the sustainability of natural resources and the reduction of pollution.

1.1 Background

Industries represent a fundamental part of commercial development throughout the world since it satisfies the products and devices demanded every day. The food industry, in turn, covers a set of industrial activities aimed at the treatment, transformation, preparation, preservation, and packaging of food products. (Smukowski & Brusk, 2011). The daily food demand has generated a massive production that categorizes this industry as one of the leading in the world. In the analysis performed by (Smukowski & Brusk, 2011) the increase in sales is attributed to the increase in demand for beverages and processed foods, especially in developing countries where the market has not been saturated yet.

Currently, the food industry faces the challenge of business competitiveness, which consists on increasing sales and acquiring profitable income by sophisticated manufacturing products that attract the consumer and stakeholders. (Ronnenberg & Mahmoodi, 2016) refers that in the global economy, companies are often looking for a source of competitive advantage that will distinguish them from competitors. It is important to consider that to be a competitive leader, the minimization of the negative effect caused by industrialization and it also has a decisive factor on the physical environment. Among the aspects to consider are the polluting emissions to the atmosphere, the discharges to rivers and the production of waste that affects the environment. (Méndez, Monserrat, & Muñoz, 2016).

On the other hand, the food industry depends on the natural environment to guarantee the supply of raw materials necessary to get products without contaminants and optimal for human consumption. Then comes the new business concern focused on environmental sustainability and the reduction of global pollution. (Smukowski & Brusk, 2011) says that, if pollution does not have the prevention or control adequately, it endangers community networks to monitor pollution and negatively affect local ecosystems.

Water is one of the indispensable resources in the life of the human being and one of the important factors in the food industry since this vital resource is used in several production

activities such as the washing of containers and hygiene in general. In some companies, the water receives a specific treatment to ensure the complete elimination of odor, taste and ensure the existence of uniform conditions. Unfortunately, this vital resource has been the most affected in the world ecosystem since the waste effluents generated in the food industry contain an extremely high level of soluble organic matter. (Smukowski & Brusk, 2011).

According to (Méndez, Monserrat, & Muñoz, 2016) The accumulation of pollutants over time represents an important risk that can affect the quality of lifestyle of the population and the environment. According to the author, it is essential to seek solutions that ensure environmental wellbeing and to achieve sustainable economic growth that according to (Pozos, Lucila, Márquez, & Pilar, 2016) requires the ability of entrepreneurs to identify these factors as an improvement opportunity that can generate a competitiveness of the companies and the common welfare. For this reason, the concept of business management has emerged, which specifies the process that must be carried out to achieve long-term, medium- and short-term objectives and goals (Méndez, Monserrat, & Muñoz, 2016).

The business management over the years has tried to encompass both the internal organizational functioning and maintain the structural and functional harmony of the system that configures with its environment. Although the application of management is responsibility of each company, there are also organizations that ensure corporate compliance and provide adequate information to perform the management. In the case of environmental management, the most commonly used regulatory systems are those established by the ISO 14000 series of standards and the EU Eco-management and Eco-Audit Community System "EMAS" (Méndez, Monserrat, & Muñoz, 2016).

"Nowadays, proactive and strategic firms are including Environmental Management System implementation, as a business strategy way to improve the environmental bottom line" (Ronnenberg & Mahmoodi, 2016). Industries have implemented strategies that have allowed the development of production skills to acquire quality standards and customer recognition. Although the implementation of the management is in accordance with the objectives established by each company, according to the author (Pozos, Lucila, Márquez, &

Pilar, 2016) this implies acquiring the necessary skills to have a vision of the future and the values required to be able to face the complexity.

In every organization there are opportunities for improvement and challenges that must be faced to achieve success. Among the difficulties encountered during the implementation of the environmental management system has been the lack of knowledge about the application of green practices, the lack of infrastructure in the local context to support the environment, the decrease in productivity and economic aspects. (Méndez, Monserrat, & Muñoz, 2016).

Despite the existence of difficulties encountered in the implementation of environmental management, a series of competitive advantages have also been determined with beneficial results; among them, the reduction of the costs related to energy, the improvement of the corporate image, the innovation of the ecological practices and the offer of suppliers (Méndez, Monserrat, & Muñoz, 2016). This is what (Baumbach, 2013) says in the analysis conducted by the State of Selangor where showed that improved corporate image is the most substantial benefit brought about the implementing of EMS. (Méndez, Monserrat, & Muñoz, 2016) specifies that the main reason for good environmental practices has been cost reduction and innovation.

Large and small companies that have implemented environmental management have gotten great business benefits, however, small businesses face greater difficulties in their implementation because it does not have the standard design of processes which is indispensable factor for the success in the management. This is affirmed by (Baumbach, 2013) mentioning that to improve environmental management, companies must to focus their attention to the whole production process, including design, raw materials, manufacture and recycling.

One of the industries characterized by small companies is the dairy production, therefore the knowledge and implementation of environmental management has represented a great challenge to eliminate polluting residues such as whey. This residue although it is used in cattle feed and the remaining volume is discharged into the environment, was discovered that

this product serves for other certain industrial functions. (Parra, 2009) It affirms that a number of commercial uses have been developed such as ethanol, organic acids, non-alcoholic beverages, fermented beverages, biomass, concentrates, isolates and protein hydrolysates, films edible, support medium to encapsulate substances, xanthan production, enzymes, separation of lactose for sweetening purposes in food among other applications.

Traditionally, the cheese producers have considered the whey as a residue, eliminating in the most convenient way the resulting amount, however, treatments have also been carried out for its use, including electrodialysis, depuration by electrocoagulation, co-digestion, and dark fermentation, as well as the development of multiple jobs in which different configurations and operating conditions have been used to improve the process operation. Although a large amount of research and waste treatments have emerged to analyzed the dairy by-product, there is still a large percentage of whey that is thrown into the environment and its nutritional value has not been considered by many producers to develop new products that can be acquired by hundreds of consumers around the world (Alamo & Oquendo, 2007).

In the micro-enterprises of dairy production there are also other business challenges that affect the profitability and productivity; according to (González J. M., 2010), it is characterized by the inadequate control that can affect the profitability and increase the opportunity for improvement; among which can be mentioned:

- Increasing of domestic markets resulting from the negotiation of international trade agreements.
- Lack of research and development of new technologies for the dairy sector related to the natural conditions and productive reality.
- Improvement of the industrial sector competitiveness and the search for new stable markets.
- The emergence of environmental, health and technical requirements.

It is important to mention that small companies are a fundamental part of industrial development, so their improvements must be dynamic and achievable. (Pozos, Lucila, Márquez, & Pilar, 2016) mentions that, if small industries want to stay in the market and keep

growing in a global environment, they must create a plan dedicated to strategies focusing on business development. It is indispensable to keep in mind the several aspects that must be considered to achieve the best industry performance, such as process, cleaner production, control, and human welfare. According to (Baumbach, 2013) among the factors that should be considered are the general function, environmental management and strategic environmental policies.

Despite the conditions that industries currently face, the concepts such as business culture, leadership, knowledge management, and product innovation must be included in the production plan to reach the productivity and guarantee the adequate use of available resources (Pozos, Lucila, Márquez, & Pilar, 2016). Unfortunately, the inappropriate customs of the human being in terms of waste management have adversely impacted the environment, which it has forced to companies to propose new strategies to recycle the waste produced by the process through the employee awareness and in this way the accomplishment of goals and more benefits.

1.2 Problem Statement

The dairy industry is one of the production sectors with high demand and profitability; it is characterized by the diversification of products in large, medium and small industries throughout the world, however, nowadays it is faces an alarming focus related to the emergence strategies in favor of the environmental management since its production is recognized as one of the most polluting industries in the world due the production of waste in its manufacturing which it deteriorates the natural resources necessary for the existence of all human beings.

The waste in dairy products can affect such resources as air, water, and soil, increasing environmental pollution and the wastewater. Unfortunately, the artisanal cheese production has one of the pollution sub-product of the milk called “whey”, which has in its components the lactose, proteins, and some other minerals. Due to the high organic load, the biochemical and chemical demand for oxygen, and total suspended solids is considered the most pollution waste in dairy production (Guerrero, Ramírez, & Rosas, 2013).

“Approximately 47% of the 150 million tons of whey are discarded into the environment and that waste is increasing 2% in the world every year” (Guerrero, Ramírez, & Rosas, 2013); This fact affects the environment stability of the planet, which has alerted the artisanal sector due to is recognized with the major percentage of production that generate the greatest waste and it is characterized by the lack of demand for quality and hygiene requirements of raw material and the lack of sanitary regulations in its production (FENAGH, 2013).

Although different methods of discarding whey such as the wastewater treatment and recycle have been determined over time, the small and medium industries don't consider it as a good option due to the high investment cost. Only the large cheese manufacturing companies are in the position of implementing technologies for their production and innovation strategies. Nevertheless, due to the demand of the market and the innovators products based on sustainable resources have motivated the generation of methodological proposals that can be implemented by small and medium industries (Illanes, 2011).

The lack of previous waste treatments and the absence of the environmental management system in the small and medium dairy industries such those located in Honduras, which is a country located in Central America where the artisanal industry represents 48% of production have represented a problem for the environmental care and the development of the country since it generates negative impacts on its production (FENAGH, 2013). This fact is replicated in all the small industries that do not have the adequate information to implement sustainability controls worldwide, due to this it is recommended the planning of environmental methodologies that analyze the opportunities for improvement of their processes.

1.3 Objectives

1.3.1 General Objective

Design an environmental management proposal based on the ISO 14001: 2015 standard, which allows reducing the pollution in small and medium industries through the analysis of the environmental situation of artisanal dairy production.

1.3.2 Specific Objectives

1. Analyze the dairy artisanal manufacturing process, the environmental conditions and the impact of throw waste into the rivers and lands in Olancho, Honduras.
2. Identify the latent and potential pollution points of production of artisan cheeses in Honduras to determine preventive activities that avoid waste into the environment.
3. Elaborate a proposal of an environmental management system that contains the necessary guidelines to improve the environmental conditions of small dairy industries.
4. Proposing solutions to avoid the pollution "methods to reduce the water pollution" and guarantee compliance of quality in dairy artisanal process; based on the ISO 14001:2015.

1.4 Justification

The dairy industry increases its production every year, offering to the consumers different products as the cheese. Unfortunately, in their processing it discards the “whey”; this sub-product has not much commercial value since the cheese and casein producers have traditionally considered as a waste, being its handling oriented towards its rational disposal without treatment. This affair has alerted many companies to improve their disposal systems and the inclusion of methods in favor of the environment (Shete & Shinkar, 2013). This inclusion of environmental methods not only generates a series of benefits to the environment but also to the company in general.

Being environmental pollution a global issue, the development of a proposal for environmental management can significantly strengthen the functions of biodiversity, water supply, risk reduction and soil conservation through the care of ecosystems, the restoration of degraded areas and the reduction of deforestation. The activities included in the proposal of environmental management system can also allow guiding the decisions to achieve a good performance of production that controls the environmental impact of the products and services of all the organizations, besides improving the image of the small companies achieving a greater penetration of the products in a wider market (Barquero & Medina, 2015).

Due to all these reasons many companies have encouraged to be interested in environmental practices, considering the elaboration of environmental proposals. Moreover, a high percentage of pollution have been increasing in small dairy industries without a clear vision about their commitments related to the environment these days. Some industries are starting to get involved with this issue, due to their products have begun to be include in niche markets that demand quality certification (Deháquiz M., 2012).

Despite the economic aspects represent one of the biggest problems of implementation in the small and medium dairy industries; according to (Pozos, Lucila, Márquez, & Pilar, 2016) The adoption of ISO 14001 can bring many benefits to organizations, such as lower operational costs, increased competitiveness, risk prevention, enhanced reputation, and improved environmental performance. Moreover, the use of new technologies and

methodologies that allow the evolution in their processing would not represent a big challenge with the implementation of a management system based on ISO 14001; (Ronnenberg & Mahmoodi, 2016) affirms it is the most widely accepted environmental management system certification that allows to generate a competitive advantage that contemplates each one of the improvement opportunities of the organizations, ISO 14001 seems to be accompanied by higher improvements in environmental and quality performance in the short term than in the long term (Testa, Rizzi, Daddi, Marzia, & Marco, 2013).

1.5 Scope and limitations

The artisanal dairy industry has been increased these days, becoming a pillar of the economy which it represents a great job opportunity for many farmers; its development can be driven by the approach of clean production practices, marketing management, and technology; however, the importance of environmental management should not be left behind that this requires, since, being products manufactured by handmade, the quality and hygiene is lower than industries and there is a lack of waste method treatment.

The scope of this project involves the design of an Environmental Management System that includes the methodologies that must be implemented by small dairy companies, determining the tools necessary to reduce water pollution caused by the whey produced in the manufacture of cheese. The design was based on the ISO 14001: 2015 standard, that has as aims, to reduce pollution in the environment and the inclusion of resources available in processing to achieve business competitiveness nationally and internationally. In that way, the proposal will contribute to the reduction of pollution, the improvement of quality in the processing as well as the organization of the activities necessary to produce cheeses.

Due to the territorial extension and many artisanal producers in the Central American region, the rehearse carried out a rigorous selection of the area with the highest influence and production of cheeses, choosing Honduras as the second producer with a total of 96,622 livestock producers, of which 48% are small producers (FENAGH, 2013). According to (Baumbach, 2013) there has been a growing interest in programs and subsidies to promote ISO 14001 among small and medium-sized enterprises, especially among those located in developing countries. The environmental management proposal was developed through the analysis of this area, taking an account all the factors responsible for pollution.

Small dairy industries in Honduras represent a fundamental part of the country development, where dairy production is possible in a large part of the territory due to the livestock wealth it has. The analysis to design the proposal of environmental management system was limited in Olancho, Honduras; since according to (Molina D. , 2010) it has obtained the highest level of artisanal production in recent years. With the proposed

environmental management, small industries may have access to the information necessary to generate sustainable resources.

The proposed environmental management was limited to the financial resources available to small businesses because according to the author (Méndez, Monserrat, & Muñoz, 2016) The sustainable position is specific to each company and its scope depends on the economic capacity and openness to the environmental vision to acquire an ecological commitment in the business plan. According to (Baumbach, 2013) the high costs can no longer be a barrier insofar as the company starts with a basic environmental management system and gradually turn it into a more sophisticated system. This fact makes it possible to ensure that the proposal can be modified depending on the needs and budget of each organization.

1.6 Expected results

The design of a proposal for an Environmental Management System in the dairy industry expects to have a series of favorable results in the development of industrial competitiveness, such as recognizing of the environmental conditions in which the industry develops to achieve friendly practical activities to the industry environment and offer to artisanal producers a series of actions destined to reach their objectives that lead to environmental recognition and quality processing.

In addition, it is expected that the proposal be used to enrich the knowledge of artisanal producers regarding the care of the environment. It can be used in administration and improvement for all small and medium enterprises that wish to start the implementation process of environmental management based on the ISO 14001: 2015 standard at the national and international level. The proposed Environmental Management System is expected to be a tool that provides the methodology that must be carried out to increase the efficiency of the practices in the artisanal industry.

The proposal design of an environmental management system seeks to be a useful tool for the implementation of actions that integrate economic and environmental interests emphasized on the prevention of environmental impacts to achieve continuous improvement. It is expected to reach the standardization of the process and the sustainable development to supply the demands of the market and the raw material required in the processing.

It is expected that the environmental management system complies with the control and the planning activities necessary in the artisanal dairy production to define the objectives, environmental policy, employee responsibilities and organizational structure. Moreover, to promote small and medium-sized enterprises to be recognized at the industrial and social level, and to achieve the reduction of environmental pollution to ensures the compliance with current regulations.

1.7 Organization

The thesis referred to as "Proposal for an Environmental Management System to the dairy industry based on ISO 14001: 2015" is divided into 4 chapters. Chapter 1 presents the introduction about the topic used to develop the environmental management proposal, including the problem statement, the justification of the research and the general perspective of the current situation regarding environmental pollution. It also defines the general and specific objectives, the limitations and their results, which specify the use of the proposal for an environmental management in small and medium-sized enterprises and the benefits that can get it if the proposal is included on their planning.

In chapter 2 establishes the contextual framework in which it is explained if the situation supported by the environmental management proposal. It explains the current situation of the dairy industry in relation to environmental pollution, which affects natural resources such as air, water, and land, generating the lack of optimal living conditions for the world population; For this, the condition of small industries in Honduras is explained, considered as an example of the situation of the whole world faces. This chapter also addresses the research conducted on the problem of the increase in waste in processes, culminating with the explanation of the benefits that can generate environmental management proposals at the social and industrial level.

Chapter 3 details the theoretical framework, which defines each of the terms used in the environmental management proposal and presents the continuous improvement cycle as the basis to establish a model that aims to reduce pollution. The defined terms are the necessary components for the generation and implementation of the model in small-medium dairy industries. It also defines the ISO 14001: 2015 standard as the basis for the definition of the proposal and the standardized implementation at an international level. Some of the defined terms are the requirements for the implementation for an environmental management system, whey as a by-product and the dairy industry as the industry with opportunities for improvement.

Chapter 4 presents the design of the environmental management proposal and describes in detail the methodology that must be followed to improve the dairy production processes

and to achieve the reduction of pollution in the environment. It presents a brief description of the industry conditions and the opportunities for improvement found in the artisanal cheese process. The proposal specifies step by step the activities planned with the necessary tools for its implementation and the formats that can be used for the documentation; also, it presents the flow diagrams of the processes and the training proposal to comply with the communication towards the collaborators. At the end, the conclusions and recommendations for the effective implementation of the proposal are presented.

2.1 Environmental pollution worldwide

Humanity faces one of the most dramatic and damaging problems for the environment produced by the action of human beings in their daily lives and the international industries that continuously generate harmful gases and waste in their production. According to (Solis & Amado, 2003) the waste or garbage is a problem due to the large amount that is daily generated. This alarming fact can be worst and can cause the double production of waste in the next 10-15 years due to the continuous increase in population. This phenomenon has arisen due to carelessness and the lack of interest in keeping the planet stable and sustainable natural resources. Fortunately, a few years ago, the human being has been more concerned with controlling this phenomenon that can certainly be fatal without due treatment.

Natural resources are becoming increasingly depleted and the sustainability has become a challenge for the humanity, for this reason, have emerged the global concern to face this phenomenon and the search for alternatives to control the environmental impact (Solis & Amado, 2003). This issue has most be attracted the attention of developed countries which have joined to find many solutions. Those solutions are related to the environmental assessment to reduce pollution, the optimization and the process development that requires the ingenuity and innovation of industries to protect the environment (Alaña Castillo, 2017). It is important that each company includes the social responsibility and involves the benefit of the whole community, in that way it can motivate more people to join for the common welfare.

The global environmental situation is critical where to protect the biodiversity and to maintain the quality air, land and water in the environment is one of the big challenges. This fact has allowed that different forums were held, evaluating the environmental conditions in which the human being lives. In the world economic forum, The Yale and Columbia Universities presented a careful measurement of the trends and the progress of the global environment. It was used metrics that provided a gauge on a national scale of how close countries are to established environmental policy goals. The environmental performance

index (EPI) was used, which ranks 180 countries on 24 performance indicators across 10 issue categories covering environmental health and ecosystem vitality as it is presented in the Figure No. 1 (Yale Center for Environmental Law & Policy, 2018).

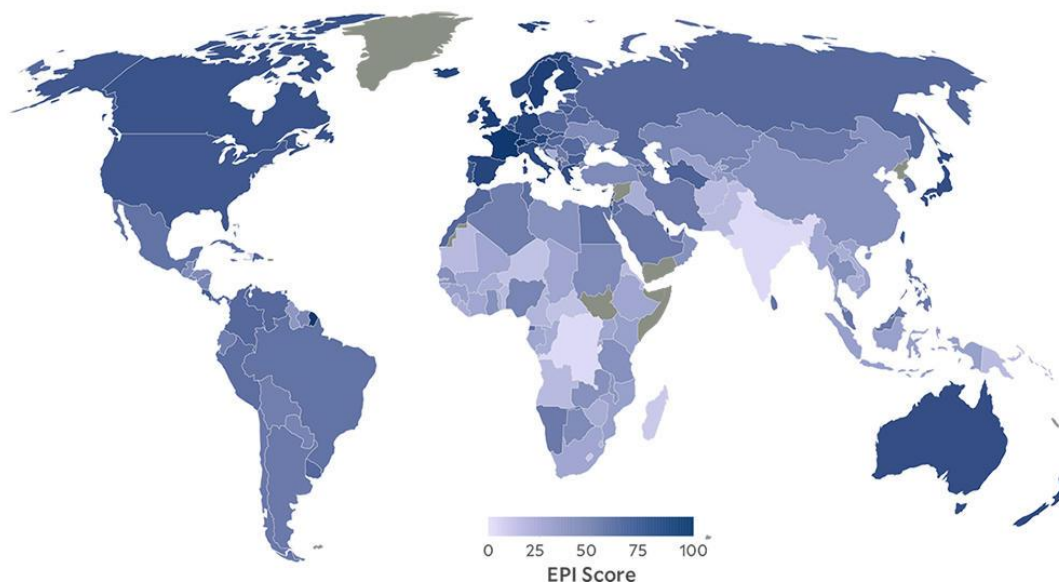


Figure No. 1 Ranking country performance on high-priority environmental issues

Source: (Yale Center, 2018)

The environmental performance index offered a scorecard that highlighted the leaders and laggards in the environmental performance, it shows the best practices, and provided guidance for countries that aspired to be leaders in sustainability. Switzerland obtained the highest score of quality air and climate protection goals with 87.42 of the score. This fact motivated to other countries to propose new environmental goals that avoid massive pollution and allow a sustainable agriculture, water resources, and waste management (Yale Center for Environmental Law & Policy, 2018).

Sustainable development is a requirement of environmental protection which leads to find solutions that support the needs of future generations and the implementation of actions that are adopted by national and international organizations. Although the environmental management involves costs, there have been benefits acquired by the participants at the end of the implementation (Testa, Rizzi, Daddi, Marzia, & Marco, 2013). The contributions of

international organizations to find the solution to the environmental problem are increasing, however, the problem now is to encourage everyone to join in a campaign against pollution. The actions carried out by the human in favor of the environment must ensure the resources and the elements for life without leaving behind the production and the policies of the industries, for this, it must evaluate the methods that the industry will put into practice in their action plan.

The solution alternatives must be chosen by a representative team in each organization that ensures correct execution, continuous improvement to achieve social responsibility and the environment related to the scope and objectives proposed at the beginning of the project. According to (Ronnenberg & Mahmoodi, 2016), this alternative solution will be useful for the environment and the organization because many steps in the process could be replaced by one of lower cost, as well as resources could be reused; An example of this is when the wastewater is treated, and the resulting water is used to carry out washing or irrigation processes.

Environmental pollution is happening around the world and although not all enterprises produce the same amounts of pollution, all nations are involved in the cause of this phenomenon. It is a responsibility of each country to make a strategic plan that prevents greater harmful consequences for living beings. In Tegucigalpa, Honduras the sewage load is of the order of 260 thousand m^3 / d, of which only debug 22.7% that is equivalent to 59 thousand m^3 / d. The rest of the sewage is discharged freely to the Choluteca River through its different tributaries: rivers, streams, and channels of winter that cross the city (UNESCO, 2015). The alarming problem is that the amounts of pollution are increasing exponentially, the population grows and there are still many organizations without any environmental management.

In other countries of the world, the pollution affects the natural resource as air, land, and water. In the case of Russia, the production of fuel is one of the largest polluting industries and therefore it is the greatest approach to evaluate and develop alternatives to improve the environmental situation. Since 1996 many researchers about pollution have been carried out. Its effects and statistics have allowed observing the evolution of the polluting waste, in 2015 it was obtained that " In 23% of Russia's cities, the air is contaminated with benzo, pyrene

entering the atmosphere during the combustion of fuel and the average concentration of impurity in a year exceeds 1 MAC" (Chernogayeva, 2016).

The human consumption has caused the development of production industries. According to the author (Barquero & Medina, 2015), the needs of the population are increasing and one the greater problems are the excessive accumulation of waste, the saturation of materials and pollution that affect the environment. These phenomena are a consequence of the lack of management and the improper use of the available raw materials. Moreover, the lack of water treatment and the lack of waste selection in garbage containers has caused terrible threats such as deforestation, droughts, and floods (Guillén, 2015).

Water treatment and sanitation is a key factor in keeping the population healthy. Polluted water not only affects flora and fauna, it also affects the health of people, especially children, producing diseases such as diarrhea, typhoid fever, viral hepatitis, etc. In Mexico, more than 6 million cases of infectious intestinal diseases were reported, from which a rate of 5 thousand 275 cases per 100 thousand inhabitants was obtained (UNESCO, 2015). Due to a large amount of population and manufacturing industries, Mexico is one of the countries in Latin America with the greatest pollution in its natural resources such as water and air. The creation of a plan that aims to reduce environmental pollution is indispensable to reduce mortality and morbidity in this country.

The events that occurred worldwide due of the environmental pollution have been devastating, the death of the human beings is increasing and the risk of acquiring a disease is possible with just breathing. According to the World Health Organization, due to the polluted air, more than 50% of deaths from pneumonia in children under 5, more than 4 million people die from diseases attributable to environmental pollution and 3.8 million people die from attributable diseases to indoor exhibition contaminated (Organización Mundial de la Salud, 2018).

The environmental situation is critical, the pollution in the environment has caused the planet an insecure place and unfit to live. The destruction of ecosystems and the death of living beings are a consequence of the massive accumulation of toxic waste that is daily emitted without any regulation. Therefore, the disturbance has impacted the health

negatively. For that reason, the sustainable development, the proper use of natural resources and the handling of industrial waste has become the greatest challenge worldwide (Organización Mundial de la Salud, 2018).

2.1.2 Types of Pollution

Population and the random growth of industry have been factors of the pollution in the cities where there is a need to take measurements such as political, environmental, economic and educational facts to keep up the resources within acceptable levels. The waste is accumulated all the time by human beings and every action carried out within the industries, it results in tons of garbage that needs to be treated to avoid environmental pollution. According to (Guillermo, 2007) In many countries there are saturated spaces by garbage thrown into lands, rivers, and mountains. These spaces are considered warning and concern centers in every part of the world.

The organizations must be concerning to find which activity of the process causes the pollution, the reasons of the increasing pollution and the consequences in the planet resources these years. That is why pollution has been classified to prevent and implement specific action plans in the affected areas where the waste has destroyed the natural habitat of animals and human life; for example, wastewater is considered a type of water pollution and deforestation is a cause of soil pollution. Currently, environmental protection specialists have defined wastewater, soil, and air as the main polluted resources (Mahajan, 2008).

2.1.2.1 Water Pollution

Water pollution occurs due to the presence of dissolved inorganic and organic materials such as proteins, fats, carbohydrates, substances found in domestic and industrial waters, and physical factors such as turbidity, color, the temperature of effluent and associated radioactivity. (Mahajan, 2008). Water pollution is one of the biggest challenges and global concerns because its existence is vital for human life since it represents one of the most necessary resource in daily life; therefore, it must be used with environmental responsibility.

Water is a resource of vital importance in the human life, its conservation must be one of the main objectives in the fight to keep the environmental quality. In most developed countries wastewater is treated in a high percentage; In 1991 the European Union created a plan for the treatment of urban wastewater which it resulted in 60% of the population was being connected to some treatment system. In 2005 this figure happened to be 92%, however, in developing countries the waste is poured into lakes and lagoons without any treatment. (Valencia & Ramírez, 2009).

2.1.2.2 Land Pollution

The land pollution occurs due to the urbanization, concentration of population, and when the deforestation is carried out on a large scale. According to (Mahajan, 2008) The agricultural operations are extended to forest and mountainous areas, these are covered with green vegetation and submerged in water by the construction of artificial barrages or dams, hundreds of millions of tons, coal, oil, ores, stones, sand and other construction materials that are mined and transported. The garbage waste, paper, packing materials and rejects from households and industries form solid wastes; this fact causes soil erosion and damage the sowing of the next crops, however, this is not the only reason for land pollution, because in some cases the wastewater, resulted of the industry production is thrown into the land, producing an infertile land.

2.1.2.3 Air Pollution

Air Pollution is caused by industries process such as sulfuric acid plants, power station boilers, nitric acid plants, cements plants, foundries, plastics industries, and dairy industries, among many others (Mahajan, 2008). Air is an essential element to breathe and perform the daily activity of living beings. Although air pollution is less perceived by the human eye, studies conducted in recent years have obtained unexpected results, representing statistics not favorable for the future generations. These studies have determined that the air pollution has affected the healthy life, increasing the likelihood of acquiring respiratory diseases; this due to the industries are the main cause of air pollution due to the gases that are daily expelled.

Environmental pollution affects essentially the natural resources, issue related with many negative effects on human health and ecosystems such as water pollution, the atmosphere and the soil due to the industrial production and the mass consumption of companies (Alaña Castillo, 2017). Every day it represents a big challenge with more difficulties where it is necessary the teamwork and the global union to achieve new improvements. Although it seems to be out of control, there are possibilities to reduce the damage to the ecosystems and to ensure the evolution of humans in the future years.

2.2 Environmental Management Background

In recent years, different phenomena have been detected, causing a damage to environmental performance and, therefore, to human beings. According to the research carried out by Zeng, Tam & Deng (2005), the severe environmental deterioration becomes it one of the most endangered urban and rural environments in the world. Each of these findings and impacts generated has allowed the use of methodologies oriented towards the preservation of natural resources and the reduction of waste material, such as the environmental management system and the management of business processes.

The authors (Testa, Rizzi, Daddi, Marzia, & Marco, 2013) define the environmental management system as a worldwide tool potentially applicable by any kind of organization to improve the management of their environmental aspects and to reach a continuous improvement of environmental performance. This management has been established by different organizations that want to achieve environmental sustainability in their processes. In one of the researches to determine the conditions of the environmental management system implementation, it was obtained that 836 small organizations related with technology had obtained ISO 14001 certification in China (Zeng, Tam, Tam, & Deng, 2005).

Environmental management has been analyzed in small and large companies to obtain conclusions of the improvements found in the implementation. The discussion in the impacts of EMAS and ISO 14001 on the reduction of carbonic anhydride mentions that the combination of the ISO 14001 EMS with additional requirements not only increase the firm's ability to have a long-term effect on environmental performance, but also validates that the

ISO 14001 is a good basic environmental tool that can be used to build a meaningful environmental management program (Testa, Rizzi, Daddi, Marzia, & Marco, 2013).

In the research carried out in micro and small food processing companies located in Puebla, Mexico aiming the analyze the factors that may be considered in the environmental management it was determined the objectives of preserving natural resources and the control that must be established in the processes. As a result, it was obtained that environmental management has not been incorporated in micro and small companies, so in the practical implications should be aware of the importance of environmental management in all industries, mainly in the processed food industry, develop the environmental value in the same and assume a responsibility with the environment in such a way that it transcends its clients, suppliers, personnel, investors or authorities and that is projected to society. In the research carried out in micro and small food processing companies located in Puebla, Mexico aiming the analyze the factors that may be considered in the environmental management it was determined the objectives of preserving natural resources and the control that must be established in the processes. As a result, it was obtained that environmental management has not been incorporated in micro and small companies

Currently, more organizations are awareness about the environmental management should be included in production activities. Because the concern around the world has focused on environmental stability, however, it has been difficult to determine the reason about why companies have decided to establish an environmental management system. In some researches, it has been concluded that there are greater business benefits. Zend, Tam & Deng (2005) says that EMS can offer opportunities for cost saving in the areas of raw materials, waste minimization, elimination of pollution, and energy efficiency.

The author Hillary (2003) also explains that EMS implementation opens new interactions between staff and management and provides intangible benefits like enhanced morale, which it seen as very important for both small firms and medium-sized ones. Other benefits announced is the quality systems are improved, the management rises training which is introduced where previously there was none, and innovation is encouraged. In the questionnaire on the Implementation Status of EMAS the most frequently cited improvements were those related to reduced energy consumption and waste minimization.

It is important to consider that the proposal for the implementation of an Environmental Management System has not been the same for all organizations, the development is oriented in relation to the proposed objectives. In the environmental management research carried out in Italy, the authors (Testa, Rizzi, Daddi, Marzia, & Marco, 2013) argued that regardless of the complexity of the organization, the nature of the reference standard seems to be linked with the way requirements are fulfilled and, in turn, with different achievements.

The process of an environmental management implementation must consider each of the impacts that the current process entails and to consider the resources available for its development since there are many external and internal barriers that may delay this process. Regarding the environmental management system and smaller enterprises, the internal barriers identified in the review study are the grouped into the following four categories: resources, understanding and perception, implementation and attitudes and company culture. These barriers can have a negative effect on the fulfillment of activities in the defined time and it represent a threat to the project success (Hillary, 2003).

Among the barriers that were mentioned in the research, according to (Hillary, 2003), are the implementation is an interrupted process, inability to see relevance of all stages, internal audit independence difficult to achieve in a small firm. In addition, they can also exist doubts about ongoing effectiveness of EMS to deliver objectives, difficulties with environmental aspects/effects evaluation and the determination of significance, uncertainty about how to maintain continual improvement, lack of clear or strict legislative framework, absence of a central source of information on environmental legislation. These barriers can be controlled with a correct strategic plan and a simple proposal that includes contingency actions.

The environmental management proposals established have that for the development of the project there are different practical implications that must be considered. Researches in China industries claim that the environmental consciousness of enterprise is indispensable in environment protection. In addition, the government should play an important role in promoting environmental management (Zeng, Tam, Tam, & Deng, 2005). The business management proposals must be included in the public organizations of each nation, and thus attract the attention of all production companies.

On the other hand, the evaluation carried out in Manchester Metropolitan University Engagement argues that a wide range of stakeholders, commitment from senior management and executives, collaboration and shared ownership of an environmental vision and strategy are critical success factors for the environmental management processes. These factors must be included in the practices of an environmental management system and in this way generate a greater amount of benefits. The process can be tedious; however, the organization must to maintain the direction in the fulfillment of proposed objectives (Hillary, 2003).

In the model for small dairies in the Industrial Corridor of Boyacá, Colombia, it is stated that environmental management should be viewed as a very useful tool for the dairy industry, both economically and commercially. One reason is due to in dairy companies, it has been established that raw materials, due to their organic nature, are easily damaged, affecting handlers, the surrounding community and consumers. The implementation of an Environmental Management System in the industrial sector is functional to improve production, since a significant percentage of small dairy companies are operating with a weak regulatory structure as it have no clarity on standards or legal requirements, this due to lack of support by organizations such as Chambers of Commerce and the autonomous regional associations (Deháquiz M., 2012).

The established proposals have generated great improvements in production, reducing the waste by treatments that avoid the radical damage of natural resources as well as increasing business profitability. Currently, organizations have implemented the environmental management system to obtain benefits that allow them to be market leaders, since this fact represent the great concern these days.

2.3 Dairy Industry Pollution

The dairy industry includes all the production of perishable food such as milk, cheese, and butter, which are very important products in human nutrition and therefore generate a high demand in the market. Their production has formed part of the industries with the highest profitability worldwide, since its consumption has been increasing over time, but the waste in its processing as well. The dairy industry, due to its diversity of processes, and products,

generates a large amount of solid, liquid and gaseous wastes, which are increased by improving their productivity, quality and health (González M. d., 2012). This waste has been involved in the environmental pollution since it is one of the industries with the highest daily production, it generates more waste.

Global demand for dairy is expected to increase by 2.5 percent per annum to 2020, largely driven by increasing urbanization and rising incomes in emerging markets (Pieters, Michael, Patrick, & Rob, 2017). The dairy industry in urban areas increases over the years; small, medium and large companies are planning to launch new products using the marketing to attract the largest number of consumers, as well as small farmers are looking for ways to earn income by milking cows and selling handmade products; in this way dairy products take a giant step in the growing market.

The increase in global demand is a favorable factor for the dairy industry and the economy of each country since the gain of production will increase and in turn the benefits for employees, however, the need arises to generate and maintain a management system that allows to have more environmentally friendly practices since the waste that results in the production may contain a high degree of pollution, harmful to the environment and human being. This waste generated in the production will depend on the chemical compounds of the manufactured product that are released into the environment without any treatment.

The dairy industry is the manufacturing derived from milk, such as cheese, butter, and yogurts. Each of these products has different activities in their processing, and as a result, liquid, solid or gaseous waste with different percentages of contaminants; an example is the cheese that as a result gives the drainage of whey. The product whey in volumes significantly high turns its process as the most important when evaluating the environmental aspects associated by its content in lactose, fat, proteins, minerals, vitamins responsible for the high values of chemical oxygen demand (BOD5 Y COD) present in it (González M. d., 2012).

Dairy industries are part of the livestock sector because the raw material is obtained from the cows and then it is taken to artisanal processing or with sophisticated machinery. During the whole process are released emissions of gases and waste into the environment without any treatment. Although some companies have socially responsible practices already, small

industries continue to operate without any basic environmental management system. Food & Agriculture Report 'Livestock's Long Shadow' states that the livestock sector is responsible for 18% of overall greenhouse gas emissions in CO₂ terms (Pieters, Michael, Patrick, & Rob, 2017).

Some countries carry out an annual evaluation of industries, verifying their production and polluting residues that significantly affect their environmental performance and the proposed objectives. In the case of the dairy industry, it is essential to verify and to make a research about the annual production and the waste exceeds determined by the environmental tolerance limit. In Netherlands, research is underway to explore the use of technology to produce bioplastics, bio-textiles and bio-paper from methane (Pieters, Michael, Patrick, & Rob, 2017). Every study about milk production are carried out with large companies, however, one of the most polluting residues continue being the whey, a product that is discarded in water and nearby soils in small-scale artisanal production.

The dairy industry generates an average of 2.0-2.5 liters of wastewater per liter of processed milk, the effluent contains soluble organic, suspended, solid, organic traces (Shete & Shinkar, 2013). Wastewater is the product of the combination of solid and liquid waste that is discarded in the river or soil, causing the death of many aquatic animals, the threat of disease in terrestrial animals and the extinction of flora in contaminated places. This situation harms the stability of natural resources throughout the world and that increases the concern of environmental protection organizations.

The dairy industry is one of the productive sectors with the greatest impact on the environment, the diversity of processes and products in this sector requires continuous review about the production plan to reduce waste and to find alternative solutions that generate a responsible environmental process. According to (Shete & Shinkar, 2013) the butter, cheese, and buttermilk are products that involve waste trigger processes and wastewater source. Therefore, its processing must be fully evaluated and directed by regulations that encourage alternative processes to ensure environmental sustainability.

The dairy production requires a series of steps necessary to obtain quality products with texture and flavors defined. The previous processing of the milk requires a sensory, physical,

chemical and bacteriological analysis that as objective has safety food. Dairy derivatives use all the nutritional components of milk as raw material and the cheese is a way to preserve the nutrients of the milk when its trade is not possible and a way to raise the economic income of artisanal processors (Rubí López, 2011).

Milk derivatives are products that are sensitive to environmental factors since it is perishable foods that require adequate handling at all stages of production, as well as milking, transportation, processing and manufacturing. (Rubí López, 2011) specifies that the hygiene and the standards of sanitary handling of milk must be integrated into each phase of dairy production. However, the design of adequate production planning requires a set of standards that guarantee the reduction of pollution, food safety and quality manufacturing.

The environmental impact generated by liquid, solid and gaseous discharges in dairy production represents a determining factor in environmental pollution. The author (Estévez, 2013) states that in the production of cheeses there are large amounts of spilled whey, becoming the largest pollutant load of wastewater from dairy products plants. As it has been researched, it is mainly attributed to artisanal plants in the rural areas of the country.

The integration of grouped procedures that ensure cleaner production, good manufacturing practices and business management is essential for proper business planning. The implementation of prevention alternatives in conjunction with the procedures generates a great environmental advantage that apart from solving the problem of waste generation, promotes sustainable development, ensuring the conservation of available resources. On the other hand, the manufacture of artisanal cheese supposes a series of improvement opportunities that can be corrected and prevented with the help of a previous analysis of the processing, evaluation of critical control points and the design of an environmental management model with its respective alternatives of improvement.

2.3.1 Environmental conditions in Honduras

Honduras is a country located in Central America with 112,492 km² of land area, immersed in a generally unsustainable development process. Even though according to the

statistics, Honduras is one of the countries with modest development, it faces many environmental challenges caused by the ecological footprint of the human being. The management of toxic waste, erosion, water pollution, and deforestation are some threats that must be attacked as soon as possible to avoid major natural disasters, reduce precarious health conditions and to ensure the quality food for the population (Palerm, Florez, & Nusselder, 2013).

The environmental strategies in Honduras are promoted with the objective of achieving the sustainability in the country, but this issue has been difficult since it is risky to prioritize environmental challenges year after year (Palerm, Florez, & Nusselder, 2013). In recent years, strategies have been proposed to promote development for the economic sectors like agriculture and livestock; however, very few proposals are dedicated to the care of the environment. To eliminate sewage, specific treatments have been used for industries; According to the research carried out by Smukowski & Brusk (2011), it affirms that the dairy industry has defended the aerobic treatment of biological wastewater. Numerous production centers have invested heavily in active sludge systems, biotors, sequential chemical reactor by load and packet treatment; however, almost nothing has been done in small industries.

The interest in water and energy conservation has led many dairy production facilities to reduce the consumption of this element. In the case of small industries there has not been wastewater treatment and for this reason the concern in the country and worldwide (Smukowski & Brusk, 2011). According to Guillen (2015); Water is one of the most polluted resources in Honduras and although it is important to mention that there is no systematic monitoring of this resource in the country, it can be affirmed that the Choluteca, Chameleón, Banana and Ulúa rivers are the most polluted since they receive sewage, industrial waste, agrochemicals and garbage deposits in their surroundings. The hypothesis states that the cause of the national water problem is due to the governance of production regions, like the northeast and south of the country.

It is important to promoted new strategies to improve the situation in Honduras these days, since according to Smukowski & Brusk (2011) if the streams or watercourses receiving the effluents are little and the volume of waste is abundant, it will use dissolved oxygen in the

stabilization process and contaminate or degrade the water by reducing the levels of this element to figures lower than those that require normal aquatic organisms. This fact not only kills aquatic animals but also limits the availability of clean water sources in urban areas and prevents the use of this resource in daily living. In the case of Olancho, Honduras; considered the cattle region, the largest amount of artisanal dairy products is processed, and therefore a large amount of waste is thrown into nearby rivers (Molina D. , 2010).

As a result of the problems facing in Honduras, an organization has emerged to identify and prioritize appropriate national mitigation actions that aim to increase the productivity of the farms involved, to ensure the sustainable management of natural resources, avoiding the land degradation and improving its resilience to climate change to generate higher incomes and to reduce poverty in rural areas (Canu, Wretlind, Audia, & Tobar, 2018). Despite the efforts of this organization to define each of the environmental problems in the country, this has not been enough to reduce pollution in the most affected areas.

2.4 Strategies for Whey Management

The dairy industry has studied the possibilities of using the waste generated in artisanal and industrial production through the evaluating of resources and the financial feasibility to determine a system that generates the greatest benefit for the company and the environment. Although the implementation of waste management systems involves many investment expenses, new strategies have also emerged, offering great opportunity to small and medium enterprises when it has the intention to get an environmental recognition and process optimization.

Due to the whey has liquid consistency with low concentration of suspended solids and is biodegradable, one of the strategies for waste management in the dairy industry is the generation of biogas, an example of this is the dairy and energy company of Chile, which uses UASB reactors, to extract proteins from whey and generate protein concentrate to be sent to the biodigesters and generate electrical and thermal energy. In Argentina, the analysis of biogas generation from acid cheese whey was also performed, obtaining, as a result, a methane potential (Corantioquia, 2016).

(Hernández, 2015) Argued: The production of biogas has been implemented in European countries such as Austria, France, and Poland, who have used the whey through the co-digestion process to generate energy. In United States the company of Crave Brothers in Wisconsin has also implemented the production of biogas, considering this strategy as an efficient in the reduction of pollutants and economic profitability since, according to studies under ideal conditions, it can generate a production of 20 m³ per m³ of serum, and this could keep running a 40-kW power generator for 10 hours per day.

The great advantage of the collection and the storage of cheese sub product is that facilitates the insertion of bioenergy generating processes in the cheese factory, which can be applied in the boiler feed and lighting in the artisanal processes; however sometimes the implementation requires a large financial investment and technology, which many small and medium enterprises do not have it available, economic strategies have emerged with great feasibility such as the installation of a reverse osmosis plant for the preparation of concentrates for food pig and bovine animal; and the manufacture of functional foods for the human being.

The whey as animal feed is one of the most economical alternatives that small producers can implement it to develop higher productivity and controlled waste disposal. In these cases, the whey can be used without any treatment or with more processing; it will depend on the quality desired and the recommendations that the experts have regarding the volumes and diet required according to the type of animal (Muset & Castells, 2017).

Another alternative used in the dairy industry is the production of functional foods based on whey, which represents a promising and competitive future for small industries, mainly for Latin America since the increase in dairy products has become visible over the years. This is the case in Colombia, who currently use acid whey to produce non-fermented beverages, while the sweet whey for fermented beverages. (Muset & Castells, 2017).

Among other applications for the whey management in dairy industries have been implemented the production processes for a bakery, cheese, desserts, confectionery, meat

products among other, which bring several benefits of nutritional value for the human health. Another function of the whey has been the elaboration of products for the diet of athletes and energy drinks that bring muscle benefits as the tissue regeneration (Hernández, 2015).

It is important to realize that in the application of functional foods according to (Hernández, 2015) the whey protein contains a high level of glutamine, being effective in improving cardiovascular health and glutamine status. The researches carried out about the properties of the whey have served as an opportunity for improvement in the management of waste in the dairy industry, avoiding the progressive pollution of the environment and encouraging all dairy industries to maintain an environmental system and the collection of whey for external use.

3.1 Dairy Industry

The dairy industry is a sector of food production that has the milk extracted from cows and other mammals as a raw material. Milk is one of the food basics for humanity and it is related to the manufacture of other products such as yogurt, cheese, butter, ice cream, among others. The dairy industry also includes all activities related to the feeding and rearing of dairy animals (milking cows, replacement stock and surplus calves from milked cows that are fattened for meat production), milk processing and the transportation to dairy processing plants, and transportation of products from dairy to retailers (Agriculture, 2016).

The dairy production can vary depending on the product to be manufactured, however, the raw material must be pre-processed. According to Smukowski & Brusk (2011) The milk is received in tankers and unloaded. The deposits are checked to verify the existence of drug residues and temperature. The milk is filtered and stored in tanks. Its temperature must be below 7 ° C and must not be maintained for periods longer than 72 hours.

Then the milk is skimmed, the untreated cream is stored in the same production center or in another location and the remaining milk is pasteurized. The cream must meet the same conditions of temperature and conservation referred to milk. Before or after pasteurization (heating at 72 ° C for 15 seconds), vitamins can be added. In case it is added, the appropriate concentrations should be administered. After pasteurization, the milk is transferred to a storage tank. Then it is packaged, refrigerated and its distribution begins.

The dairy industry is divided by two production's way; The artisanal production uses homemade tools for the manufacture of cheese, butter, cottage cheese among others, and the industrial production uses sophisticated machinery in its manufacturing. Both dairy industries are important for human consumption, and although it has different production conditions, the artisanal industry is integrated into the production chains that use marketing channels to reach the final regional and national consumption markets. Regardless of the dairy companies' conditions, the main objective of all current production centers is obtaining

safe and high-quality dairy products. Although according to Smukowski & Brusk (2011) the recent technological advances allow greater sophistication and automatization and the safety remains is still cause for concern.

Whole fresh cow's milk represents 82.7% of global milk production, followed by milk from buffaloes (13.3%), goats (2.3%), sheep (1.3%) and camels (0.4%) (Agriculture, 2016). The milk cow production is one of the industries with greater global strength being Asia and the United States the biggest consumers worldwide with 30% and 24% of production, showed in Figure No. 2. This allows a stable economy with many benefits to the people whose works in the production process such the farmers and the heads of the companies. There are other benefits that the milk cow has in the human health such as protein and vitamins that it can be consumed by all the population, mainly kids.

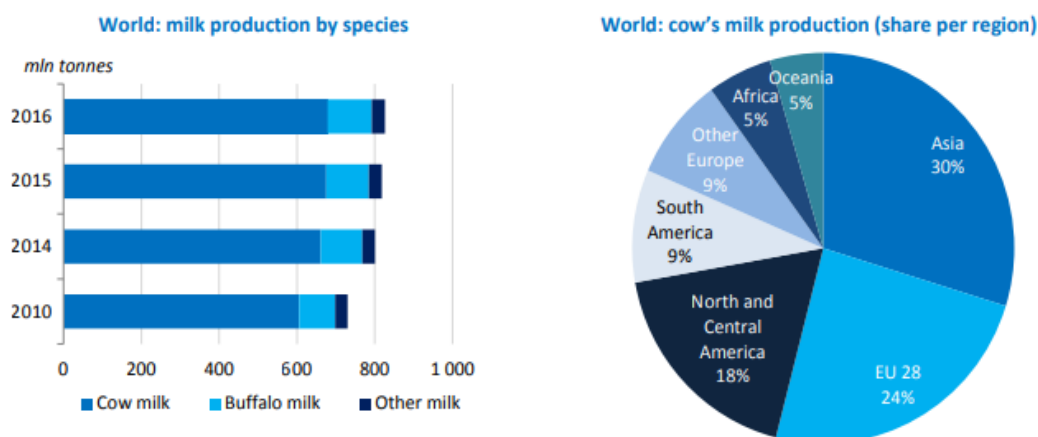


Figure No. 2 Cow's milk production worldwide

Source: (International Dairy Federation, 2018)

Dairy production is becoming more consolidated and is increases every day. Worldwide products are imported and exported from different countries to supply the needs of human beings. According to the report of 2016, the International dairy federation showed the statistics production, which according to 59 countries data, the cheese has the highest

percentage of production, followed the butter, whole milk powder and skim milk powder, Figure No. 3. (Organización Mundial de la Salud, 2018).

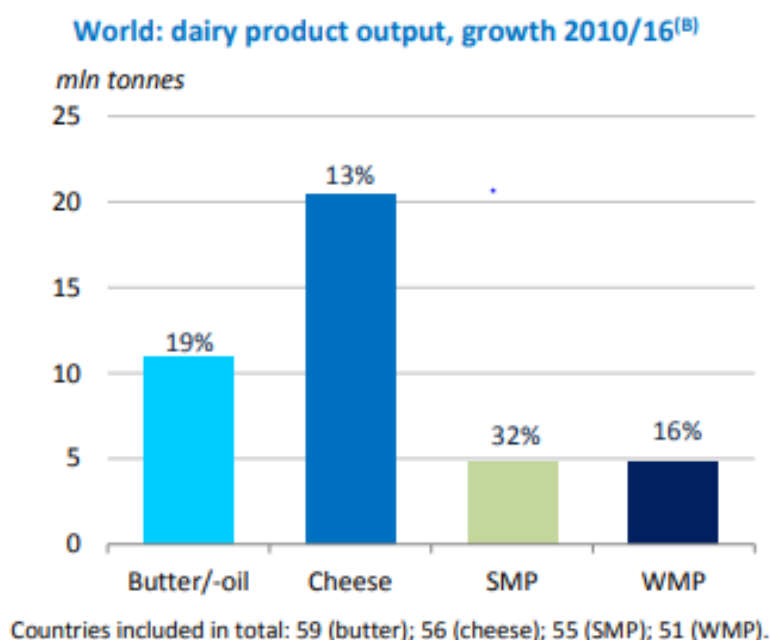


Figure No. 3 Dairy product output

Source: (International Dairy Federation, 2018)

Milk is one of the products with the highest demand worldwide, the supply and demand of dairy products in industries has become a challenge and it will increase according to the demographic growth of each region and their consumption habits. According to Agriculture (2016) It is estimated that the world milk production until 2017 was 833.5 million tons, where the increase in recent years has happened in America and Asia. These regions are supplied by large and small producers whose are making the effort to maintain production conditions and to know the needs of their customers.

The composition of quality milk depends on many production conditions such as breeding and feeding of livestock, as well as the handling of milk once extracted. These activities must be carried out using good manufacturing practices to avoid the microbiological, physical and chemical pollution. This fact it is important due to the milk is one of the main products consumed by humans that contains a series of nutrients that provide energy and stimulate the growth of the children.

According the author (Zamorán, 2016), The good manufacturing practices (GMP) represents a basic tool for obtaining safe products for human consumption, focusing on hygiene during the product handling. Some of the microbiological risks that can be acquired without good manufacturing practices according to (Smukowski & Brusk, 2011) are clostridium botulinum, listeria monocytogenes, hepatitis A and E, salmonella, escherichia coli 0157: H7, bacillus cereus, staphylococcus aureus and various parasites.

3.2 Whey

The whey is the liquid that is separated from milk when it is coagulated to obtain cheese, including all the components of the milk that are not integrated into the coagulation of casein. It is estimated that 10 liters of cow's milk can produce 1 to 2 kg of cheese and an average of 8 to 9 kg of whey (Valencia & Ramírez, 2009). Whey is the liquid that arises in the production of dairy products, especially cheese; their appearance is liquid, it has a yellowish color and a very peculiar smell. During the production, the whey is accumulated in large quantities in every factory.

3.2.1 Types of whey

The whey is the liquid yellowish, which is obtained mainly after the separation of the curd in the cheese production. Due to the dairy production has been increasing and as results the whey is recognized as a waste. According to Rojas & Ruiz (2014), it has been known for many years and has begun to be part of scientific research with the aim to avoid being discarded in the environment. The two most common types of whey are sweet and sour; the sweet whey is obtained from cheese by using proteolytic enzymes or rennet, which act on milk caseins and the acid whey is generated by the acidic precipitation of casein.

Table No. 1 shows the nutritional facts of whey and the components required in the main diet of human beings. This liquid is rich in protein and potassium, so it can be used for the preparation of edible products, which could represent the opportunity for the industries to develop new products to attract new customers. While the polluting power of whey is well known, this dairy stream also represents an excellent source of functional proteins and

peptides, lipids, vitamins, minerals, and lactose (Smithers, 2008). Unfortunately, despite the nutritional value of whey, industries have not been interested in fabricating new products using whey as a base.

Table No. 1 Composition of the acid and sweet whey

Composition of the acid and sweet whey		
Component (g/L)	Sweet whey	Acid whey
Total solids	63-70	63-70
Lactose	46-52	44-46
Grease	0.0-5	0.0-5.0
Protein	6.0-10	6.0-8.0
Calcio	0.4-0.6	1.2-1.6
Match	0.4-0.7	0.5-0.8
Potassium	1.4-1.6	1.4-1.6
Chlorides	2.0-2.2	2.0-2.2

Source: Adaptation (Rojas & Ruíz, 2014)

3.2.2 Whey Pollution

The amount of whey in dairy production has caused that industries discard this product with methods such as spray onto fields. Discharging the whey into rivers, lakes, or the ocean often prove to be troublesome due to the smell and salt, however, the very high polluting power of whey eventually restricted this disposal approach. Despite many nutritional components of whey, when this it is discarded in rivers, lakes and the ocean, it becomes a highly polluting substance due to the oxygen it absorbs, causing the death of the flora and fauna and the infertility of the lands few days later.

According to (Endara, 2002); To recognize the degree of pollution produced by the whey, the biochemical oxygen demand (BOD) and the quantitative chemical composition must be considered. These indicators refer to the purification capacity in the environment. According to the research by (Smithers, 2008), the whey does not have the ability to be dissolved in the environment. Unfortunately, this product has primarily been considered as waste by the dairy industry due to the lack of knowledge about the possible uses in protein-rich foods that recent research has found, as well as the lack of knowledge of nutritional facts.

Community pressure, especially in regional areas, has also forced dairy factories to reconsider the management of the large and growing volumes of whey generated from cheese and casein manufacture (Rojas & Ruíz, 2014). The environmental problem is growing and the alternatives to reduce the pollution is one of the main issues in the production planning. Industrial areas have shown their concern about this event and they have begun to raise new methods of waste disposal. For its part, the dairy industry has the challenge of managing an environmental system in small, medium and large companies to reduce the pollution, including the whey.

Whey-processing developments have focused on advanced liquid handling techniques, maximization of quality and safety over the past 15 years approximately (Rojas & Ruíz, 2014). The investigations of functional methods to reduce the pollution provided by waste have focused on highly polluting substances such as whey and techniques that allow taking advantage of each nutritional components, however, to achieve impact reduction of this substance in the environmental, it is necessary to handle the milk correctly from the extraction.

3.2.3 Uses of Whey

There are many uses of whey that has been researched in previous years. These uses have been functional for the pharmaceutical and food industry; among of them, the condensed and powdered whey is used to prepare the concentrated in the poultry industry and the production of beverages that are combined with vegetable fat. The whey is also used to make concentrates, extract proteins, extract penicillin, beer and as an acidifier for food (Endara, 2002).

3.3 Environmental impact

It is defined by the impact caused by the human activities that can produce a phenomenon of positive or negative character. When it refers to environmental impact includes the natural resource in which the human being develops. On the other hand, (Tayde Yesyt Gutierrez, 2014) it is defined as "any alteration in the biotic, abiotic and socioeconomic environmental

system that is adverse or beneficial, total or partial, that may be attributed to the development of a project, work or activity".

Human action produces an environmental impact, when it is a negative effect that causes damage to vital natural resources and human health itself (Onenpro, 2018). Technically, the environmental impact is an alteration in the environmental line that can cause catastrophic effects. This fact has caused the concern of human beings in relation to the environmental impacts that are currently perceived and that have caused pollution in the tides, rivers, lakes, soil and air.

To prevent negative impacts and to know the positive impacts that can trigger human action in industrial processes, the environmental impact assessment arises. The author (Onenpro, 2018) defines it as the analysis carried out to identify and to investigate the characteristics within the entire production process. (Domingo Gómez, 2013) considers that the environmental impact assessment is one of the main instruments of environmental management that uses tools for analysis throughout the project development and that is now part of the legal requirement for the approval of new projects.

The evaluation of environmental impact in industries has become one of the main preventive instruments for environmental management (Domingo Gómez, 2013). The implementation of a industrial evaluation processes with the objective to identify environmental impacts generates an environmental quality that is in accordance with the sustainable development that benefits the community and the organization. According to (Onenpro, 2018) , the performance of an adequate environmental assessment brings with it a series of significant reductions in environmental impact.

The environmental impact assessment includes the integration of the industrial projects emphasized in the environment, the participation of the members in the organization, the monitoring, and the operations control. The environmental impact assessment is the equivalent of the policies application, plans and programs that allow decision-making when a negative or positive impact is diagnosed (Domingo Gómez, 2013).

3.4 Environmental management system

The companies are currently facing the global environmental crisis and their efforts to improve their processes include the planning and the search for new methods of waste treatment that helps to reduce environmental pollution. Among the methods established to reduce pollution are the series of ISO 14000 standards and the so-called Community Eco-Management and Eco-audit System of the European Union; both initiatives serve to implement systems to formalize the policies, processes and control practices of organizations.

One of the best methods proposed to evaluate these issues is the environmental management system related with ISO 14000. This standard can be applied to small and large companies for different environmental purposes and continuous improvement. It is known as Environmental Management System (EMS) as a continual business cycle of planning, implementing, reviewing and improving the processes and actions that the company undertakes to meet its environmental obligations to improve continually its environmental performance (ISO, 2015).

Many authors have defined this term in different ways related to the environment. According to environmental management, it is the interpretation of sustainability in the organization that uses environmental technologies or adapts its processes to protect resources and the environment. Also known as the process aimed at preventing and solving environmental problems with the purpose of maintaining a sustainable development of natural resources, reducing waste and improving production processes. Environmental responsibility is a duty of all human beings and maintaining environmental stability is the obligation that every industry must assume. Fortunately, according to ISO (2015), an environmental management system has been helpful to the organizations to identify, manage, monitor and control their environmental issues in a “holistic” manner.

Environmental management is a continuous and cyclical process that includes plan, do, control and improve with purposes and objectives that are always in harmony with the policy and requirements of the organization, Figure No. 4. The PDCA cycle teaches to organizations how to plan and check to carry out corrective actions of the strategic plan. Shewhart said the cycle draws its structure from the notion of practices management evaluation since the

willingness of management to adopt and disregard unsupported idea, is the key to the evolution of successful enterprise (The Benefits of PDCA, 2002).

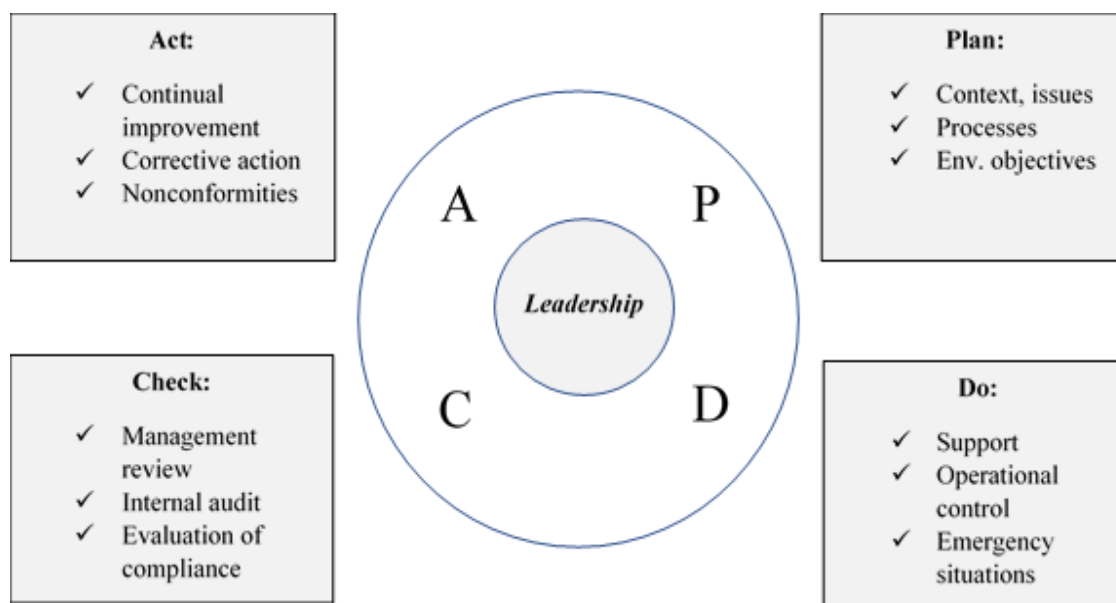


Figure No. 4 PDCA Cycle

Source: Adaptation (ISO 2015, 2018)

Plan: Refers to the first step for every activity process carried out in the organization with the aim to get the environmental management standard certification that requires the identification of operations that might interact with the environment in the future. The interactions will either be direct, such as in the manufacturing industry or indirect, such as in the primary sector like raw materials. This first step is vital to the project success since it defines the actions that will be developed throughout the process and the definition of the deadline activities. (ISO 14001:2015, 2015).

Do: Refers to the second step in the environmental management system implementation that involves the consideration of the life cycle perspective and the improvement of all the environmental aspects related to the process. This stage also involves the members of the organization and all the responsibilities to carry out the control and maintenance of the changes in the processes, the documentation for all procedures and the including operational, emergency procedures and responses (ISO 14001:2015, 2015). This part of the PDCA cycle

is very important to achieve all the proposed goals in the organization, for that reason is necessary to do the best effort at this stage and unify all the tools, skill and strategies.

Check: This stage is the key to the project success throughout the time in the organization and one of the critical points that must be audited every moment. The management team needs to make sure that the employees responsible for processes are maintaining and monitoring adequately (ISO 14001:2015, 2015). The audit is essential to continue the sequence of improvement in the environmental management plan, these revisions can occur at any time, so it is recommended to keep the documentation available and organized.

Act: It refers to the continual process improvement to ensure the planning to be conducted. The organization should consider the results of the analysis and the environmental performance evaluation to comply the internal audits and management review when it is necessary to act to improve (ISO 14001:2015, 2015). One of the key purposes of an environmental management system is to act as a preventive tool, so it's important to have a strategic to avoid the corrective actions that involves new planning.

3.4.1 Benefits of an Environmental Management System

The implementation of an environmental management system has a series of benefits; among them, the reduction of costs in the process activities, the improvement of the corporate image, the construction of the morale in the organization, and the improvement of the client's expectations (Ciravegna, 2015). The practice of the environmental management allows the integration of the employees in the organization since linked by the effort, dedication and support allows the management of leadership and fellowship. On the other hand, environmental management is aimed at maintaining environmental sustainability and its benefits are abundant since its implementation allows the internal analysis and organizational sustainability (ISO 14001:2015, 2015).

Management Systems are not the only method for environmental performance, but it can also be used as a driving force for sustainable development and the creation of value in a radical change process aimed at improving quality (Ciravegna, 2015). The implementation

of an environmental management system allows achieving greater business competitiveness since the change in its activities and strategies dedicated to the prevention and reduction of environmental pollution lead to the improvement of quality, business stability, and sustainable development.

3.5 ISO 14001:2015

“ISO 14001 is an international standard based on the concept that a better environmental performance can be achieved when the environmental aspects are systematically identified and managed to give a great contribution to sustainability” (ISO, 2015). ISO 14001 is related to environmental management and seeks improvement through pollution prevention, improved environmental performance and the compliance with standardized laws worldwide. The ISO 14001 certification is obtained through the approval of the evaluation in the organization, which it ensures the compliance with waste processing standards, improvement processes and pollution reduction (ISO 14001:2015, 2015).

“ISO 14001 certification in this regard is widely considered the tool of choice to lead waste minimization efforts, especially in developing countries” (ISO, 2015). This certification is seeking process improvement and the competitive development to maintain profitability and attract new customers. In developing countries, ISO 14001 has a greater boom due to the companies want to cover the international market, to increase the productivity and to gain in a competitive environment. Although this requires an ongoing process and hard effort, ISO 14001 promote that the small and medium companies use new strategies related with this standard.

“ISO 14001 is an internationally agreed standard that sets out the requirements for an environmental management system” (ISO, 2015). ISO 14000 is granted to all organizations that comply with internationally standards, the requirements and the description of activities to implement an environmental management system. Every step necessary in the process is published in the official pages of ISO to make it easy the implementation and the review by any organization that wishes to implement strategies of quality environment improvement. Regarding to the continuous improvement is necessary to carry out evaluations in specific

periods defined by the international organization and their approval allows achieving a favorable impact throughout the company (ISO 14001:2015, 2015).

According to ISO (2015) To implement the environmental standard it is required that an organization considers all environmental issues relevant to operations, such as air pollution, sewage, waste management, erosion, climate change mitigation and adaptation, resources, and efficiency. Production processes generate polluting waste for the environment, however, sometimes bad practices generate waste that can affect environmental pollution with greater intensity, for that reason, organizations must evaluate each operation and define critical points in the activities, identifying solutions and promoting environmental sustainability.

ISO 14001 is evaluated internationally and modified periodically to include new construction tools in the environmental management plan and requirements to the continuous process improvement. ISO 14001:2015 now requires: Environmental management to be more prominent within the strategies as well as the planning of environmental that must be included in any projects aimed at improving processes. A greater commitment from leadership and the implementation of proactive initiatives to protect the environment from harm and degradation allows compliance a successful project dedicated to the sustainable resource use and climate change mitigation (ISO, 2015), The initiatives in favor of the environment and the prevention of toxic waste should be included in the annual planning of the company, considering the creation of a department that leads the environmental development and aspects related with pollution.

Other aspects to consider in ISO 14001: 2015 is a focus on life-cycle of the project to ensure the consideration of environmental aspects from development to end-of-life and in this way the evaluation throughout the production. According to ISO (2015) this fact allows the recognition of strategies and the tools that must be used to avoid the accumulation of toxic waste; As an example, the evaluation of communication activities is a very important element among employees, and it should be established with solidity focused on finding the solution of each negative aspect in the process.

ISO 14001: 2015 is a standard dedicated to improving the environmental situations and to find the sustainable development of natural resources, as well as the design of activities aimed at continuous production improvement. It serves as a guide for the sustainable production of small and medium enterprises, explaining each requirement for their implementation and the steps to establish processes in favor to the environment that entails a series of advantages in the competitive market. Among the requirements that help to achieve an environmental management system is the definition of the objectives and to know how to get the buy-in from senior management considering the importance of leaders in the organization respect to the support of the effective environmental objectives. It can achieve a good overview of existing processes and systems that are relevant to the environmental impact (ISO, 2015).

3.6 Requirements to implement an environmental management system

For the planning, development, and control of an environmental management system, a series of phases must be carried out to determine the environmental status, as well as the proposal of opportunities for improvement in the face of the problems encountered. The phases proposed for the development of the environmental management model can be based on standards and regulations that specify the optimal processing conditions, as the ISO 14001: 2015 standard, which seeks environmental responsibility and sustainable development in production.

The environmental management model is composed of concepts that constantly move towards the improvement, following the PDCA cycle. In the planning, the context of the organization is included, leadership and the necessary activities to carry out the operation and the inclusion of all elements required as support specified in the next step. The verification involves the performance evaluation of the project and in "the act" is the key of the plantation which consists on continuous improvement (ISO 14001:2015, 2015).

The requirements of the environmental management and the approach model proposed by the ISO 14001: 2015 standard are detailed in Figure No. 5. These requirements can be used to improve environmental performance and to develop a systematic procedure to contributes as the environmental pillar of sustainability and the compliance with legal requirements (ISO

14001:2015, 2015). According to Liberato (2017), the balance of the environment is achieved if all the standard requirements are consecutively reviewed and executed by all the interested parties of the organization, considering the profitability and the consumer satisfaction.

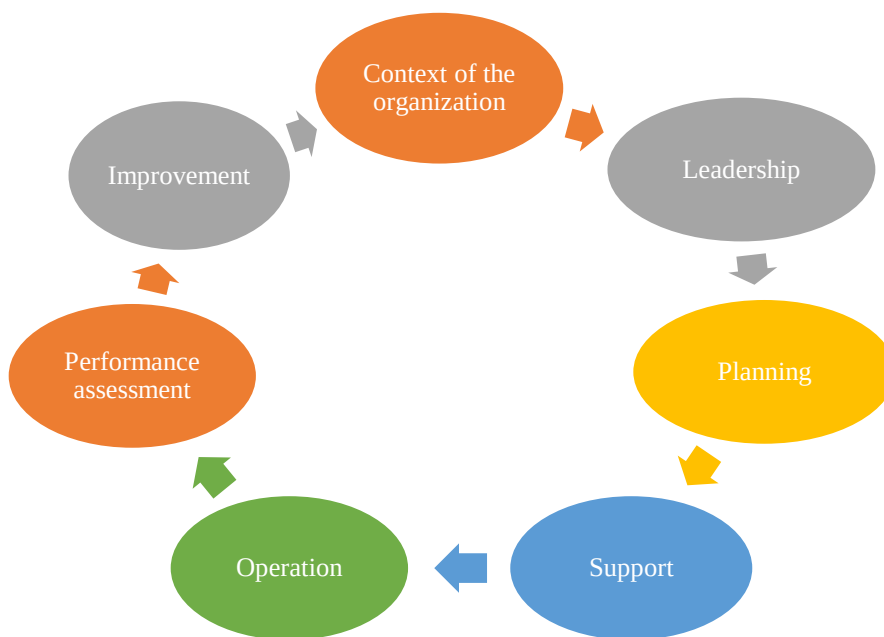


Figure No. 5 Requirements for implementation ISO 14001:2015

Source: Adaptation (ISO 14001:2015)

3.6.1 Plan

The first phase consists on the environmental inspection that includes the control activity, supervision, and the legal dispositions and norms in force of the environmental protection in relation with the objective to evaluate and to determine the adoption of the pertinent measures to guarantee its compliance (Alamo & Oquendo, 2007). The environmental inspection is important for the environmental management development since it is the easiest way to recognize and to identify the current situation and the possible activities to prevent environmental pollution in the industries. The inspection includes the evaluation of each workstations and the departments in charge to execute the process.

3.6.1.1 Description of the company

The first step begins with the detailed description of the company, listing the raw material, developed technology, administrative structure and the overall process. The description will be focused on the process useful to improve and the system to have a greater probability of impact in environmental situations such as water, soil and air pollution, as a basis for establish an environmental management system. The organization is responsible for choosing the process to be evaluated as well as the tools that will be used in the management system.

3.6.1.2 Initial environmental review

The initial environmental review is the evaluation of the current situation which the process face in relation to the environment. The ISO 14001: 2015 standard says that an environmental review consists on different phases, the first one is the identification of environmental aspects, including those that derive from the operations in normal and abnormal conditions. The following phases are the activities evaluation and the procedures about the current environmental management system, the identification of applicable legal requirements and the review of environmental management practices (Alamo & Oquendo, 2007).

3.6.1.3 Environmental policy

Environmental policy is the guiding document for corporate environmental improvement and its compliance is fundamental for the integrity and the entire environmental management success (Lombana & Vásquez, 2012). The description of the environmental policy must be clear and achievable since is related to the objectives and goals established in the company for the efficient development of the environmental management system, as well as the compliance of the activities that promote the continuous improvement of the organization.

3.6.1.4 Scope and Objectives

The objectives and the scope should describe the activities, services and products associated with the significant environmental aspects of the process to draft a cyclical

perspective and to determine the possible changes of the current situation. Moreover, it is necessary to consider the roles assignment and the workers responsibilities for the quality execution of every activity described. According to Lombana & Vásquez (2012) the identification of resources is essential to comply with the activity planning and the objective proposed, therefore, there must be effective communication relationship and awareness about the stakeholders throughout the process.

3.6.2 Do

The process aims to identify, predict, evaluate and report the effects on the environment plans, programs, projects, works and the use of the available resources (Alamo & Oquendo, 2007). This evaluation allows determining the activities that may represent potential and latent future problems. In this way, can be generated preventive and corrective actions in all the activities of the process and it can be analyzed the environmental policy proposed by the organization, measuring the level of risk and expectation for the environment. According to the authors Méndez, Monserrat & Muñoz (2016), to assure a successful process, the identification of activities must be carried out under the criterion of international standard as the ISO 14001: 2015.

The impact study evaluates any change in the environment, adverse or beneficial, resulting from total or partial activities, products or services of an organization (Alamo & Oquendo, 2007). The environmental impact of an organization is also known as the evaluation of each activity carried out with the intention to determine the possible damage that could occur in the environment and the maintenance of the process control. This phase is recommended at the beginning of a new project with an objective the environmental sustainability. The study of the impact allows identifying the severity of the polluting points to verify if the corrective action will reduce the environmental damage.

In the planning and operation, it is necessary the determination of the the controls to maintain the standard quality in their products, the communication of the requirements of each operation and the consideration of the information for the potential environmental impacts (ISO, 2015). In the operation may arise emergency situations that alter the processing, therefore it is essential to take preventive measures and revisions of the process

continuously. According to ISO 14001 (2015) The organization must respond to real emergency situations any time.

.3.6.2.1 Identification of polluting points

Alamo & Oquendo (2007) say; The latent pollution points are those that produce a permanent and intermittent solid-liquid-gaseous residual that affect the environment. This latent pollution points can persist if an alternative solution plan that avoids the polluting waste into the environment is not executed. The latent points may cause greater damage such as affect the worker's health. The latent pollution points are common when the process has not been evaluated, for that reason, according to ISO 14001 (2015), is very important have a checklist that describes in detail the schedule for the audits.

Potential pollution points are those that if the operation is adequate, do not produce contamination to the environment (Alamo & Oquendo, 2007); Although the damage may be minimal, according to Alperstedt & Bulgacov (2015), bad practices and the absence of adequate safety and hygiene measures in the process could cause pollution into the environment, generating a bad prestige of the organization. It is important that the potential problems must be eradicated as soon as possible because it can become a latent pollution points and it can increase if it is not controlled.

After the analysis of potential and latent points in industry process, the detailed review of the environmental audits of each activity proceeds to the planning of solutions called environmental management system. ISO 14001 (2015) mention the environmental management system leads to improve the process and to reduce the waste. Once the solutions are determined, is carried out the continuous system implementation, which serves to ensure the effective work of the improvement proposal in the organization and the quality condition of the product required by the consumer.

2.6.3 Check

Systematic and verification process which consists on the evaluating of the evidence objectively to determine if the environmental management system is in accordance with the

audit criterion of the environmental management system (Alamo & Oquendo, 2007). The environmental audit makes the last impact evaluation that can occur in the activities during the processing to ensure the control of all the tools that are used. According to ISO 14001 (2015), The internal audit process is monitored by a work team specialized in the analyzed process.

3.6.4 Improvement

Continuous improvement is the most difficult part to fulfill in business management since it includes several factors that must be controlled and verified. According to the author Lombada & Vásquez, the environmental management system implementation should be considered the assignment of responsibilities, levels of authority, training of staff, the administration of the documents, effective management of internal and external communications, emergency response and control over the variables that may arise in the process. To meet the objectives, the verification of each one of these aspects must be considered for the measurement of the non-conformities found at the beginning of the management.

An essential part of the environmental management system implementation is the ongoing process of the environmental performance verification related to the objective proposed by the organization to determine opportunities for the improvement and to implement the necessary actions. One way to assure the environmental performance is the ongoing monitoring, which allows the development of information and the identification of significant environmental aspects, as well as the water, energy or raw materials to meet objectives and goals. (Liberato, 2017).

3.6.4.1 *Environmental management documentation*

It is important to gather the process documentation showing the status of the project development while the environmental management system is implemented. This information is necessary to know the organization needs and it can be disseminated through department heads or digital media to all employees and stakeholders. ISO 14001:2015 mention an

organization should to create and to maintain enough documented information to ensure a convenient, adequate and effective environmental management system.

The environmental management documentation includes the environmental policy, the environmental management manual, procedures, and the instructions needed to carry out the process. Each one of the elements aims to be part of the successful changes made it, since it allows the coherent understanding, guaranteeing the compliance of system with the proposed goals to define the possible opportunities for improvement during its analysis. This documentation is called the environmental management manual and is required by the ISO 14001: 2015 standard.

The management review is the last activity carried out in the environmental management system that consists on the formal evaluation of the operation using the updated procedures and the tools used to improve the environmental performance. This evaluation can be carried out through a series of criteria previously defined by the experts of the process, using as a basis the ISO 14001: 2015 and the organization standards. After the evaluation, it is necessary to determine the causes of the findings and to implement the preventive and corrective actions in case of non-conformities on the process.

4.1 Analysis of Dairy Production in Honduras

Honduras is a Republic characterized by a traditional dairy production that in recent years has become in the second largest producer in Central America. In this country dairy production is used for four main purposes; self-consumption, artisanal production for national and export consumption, direct sales and industrial sector. Over the years, statistics have been stable, keeping artisanal production as the main purpose of the dairy sector (Enrique, Xavier, Castillo, & Ganoza, 2000). There are many artisanal industries seeking for the development of their procedures around the country and trying to find options to be the leader in dairy production.

Livestock farms in the region develop the meat and milk production, however, currently is one of the areas which present the environmental and health problem. (López, 2008) explains the general characteristics of livestock producers in the western region of Honduras which are generally represent the low productive performance due to the lack of food for livestock and the erosion generated by the burning and the lack of efficient methods of grazing. This fact is the cause of the lack of security in the meat production and dairy products and the environmental conditions to maintain the quality.

Unfortunately, the dairy production in Honduras is affected by natural disasters (floods and droughts) every year, causing the production decrease and the shortage of products at certain seasons of the year. According to the analysis made by Molina, Amana, & Banenas (2014), the dairy production in Honduras is influenced by the rainy seasons, approximately it increases by 40% in winter, causing a reduction in prices due to oversupply. Although milk production in Honduras is a profitable market for producers, it does not satisfy the necessary production requirements.

“The dairy farms represent about 71.3% of the bovine farms, meaning 68,918 dairy farms around the country” (Canu, Wretlind, Audia, & Tobar, 2018). These industries have been established in different country regions and it represent a large percentage of dairy artisanal

products. For that reason, it has become an interest factor for the consumer and milk producers, whose seek to get quality products and to acquire more recognition than their competitors. All industries seek to be profitable, no matter how different it is their product diversification.

In Honduras, all cattle herds are used to produce milk and meat primarily. According to Canu, Wretlind, Audia, & Tobar, 2018, the dairy production system becomes more important in small and medium enterprises in Honduras. As the author refers, the small industries better known as producing families have increased in recent years, that is why the Honduran population consumes artisanal dairy products in all regions of the country. These products are sold in supermarkets and small family stores generated economic benefits for the families dedicated at the dairy production.

One of the greatest benefits from the producing families is the generation of income and the opportunities to get a job in rural areas. However, despite being a profitable industry, there is a lack of leadership to guide producers towards competitive production schemes. (Canu, Wretlind, Audia, & Tobar, 2018). It refers, that these industries are generally known for products with poor hygiene in their manufacture, absence of distribution channels, and poor organization of activities. This issue should be enhanced to increase their potential customers and the market segment.

4.1.1 Artisanal Producers

The artisanal production in Honduras is the small milk producers that do not have technology for manufacturing and either hygienic materials to manufacture products such as cheese and curd. According to FAO & FEPALE (2012), the predominant pattern of dairy organization is a farm type "Family", which in the broad sense is a farm run by the producer and their family, who also contributes most of the work. Even though artisanal producers in Honduras represent a large part of the milk supply in the country, it generally operates in poor sanitary conditions and without quality materials. In the food industry, it is essential to maintain a production with quality standards because without this tool there is a high risk of acquiring diseases for human health.

The artisanal cheese industry in the country does not have a future projection plan so its production can change unpredictably. The administration of resources in the artisanal industry is disorganized, resulting in the instability of the purchase of raw material and the accumulation of waste in natural resources, discarded after production. Unfortunately, the production conditions are ignored by the Honduran population, so corrective actions that allow the development of the artisanal industry have not been used. (Enrique, Xavier, Castillo, & Ganoza, 2000).

According to Molina D. (2010), the number of artisanal milk companies nationwide exceeds 500 plants, with 41.7% of them concentrated in Olancho state. This data affirms the importance of these industries in the country and the need to identify the specific tools for the improvement mainly in the zones with major production. The processing of the artisanal industries is concentrated in the northeast and northwest regions of the country, as shown in the

Table No. 2. Approximately 197 artisan processing plants are in Olancho state with around 238,567 liters of milk processed daily, which allows to affirm there is the possibility of implementing improvements that reach an indicator of ideal production and quality.

Table No. 2 Geographic distribution of the artisanal milk processors in Honduras

Geographic distribution of the artisanal milk processors in Honduras, with the volume of liters processed daily					
<i>State</i>	<i>Artisanal milk plants</i>		<i>liters processed daily</i>		
	<i>Quantity</i>	<i>% of the total</i>	<i>per plant</i>	<i>Totals</i>	<i>% of the total</i>
Atlántida	42	8.9	2602	109,284	18.6
Colón	23	4.9	2702	62,146	10.5
Copán	65	13.8	473	30,745	5.2
Cortés	9	1.9	874	7,866	1.3
Choluteca	42	8.9	1560	65,520	11.1
El Paraíso	31	6.6	1279	39,649	6.7
Lempira	18	3.8	341	6,138	1
Ocatepeque	9	1.9	154	1,386	0.2
Olancho	197	41.7	1211	238,567	40.5
Santa Bárbara	12	2.5	1293	15,516	2.6
Valle	4	0.8	591	2,364	0.4
Yoro	20	4.2	495	9,900	1.7
Total	472	100	----	589,081	100

Source: Adaptation (Molina, 2010)

Figure No. 6 shows the collection and cooling centers of the country artisanal plants. The collectors in these centers generally do not apply an instruction that specifies the necessary control to maintain the hygiene and quality products. Due to the dairy products are perishable food, in the distribution of artisanal plants until the sale centers, the admission of chemicals such as hydrogen and peroxide are required to lengthen their expiration. This activity can affect the quality of the product, therefore, should be properly controlled. (Canu, Wretlind, Audia, & Tobar, 2018).

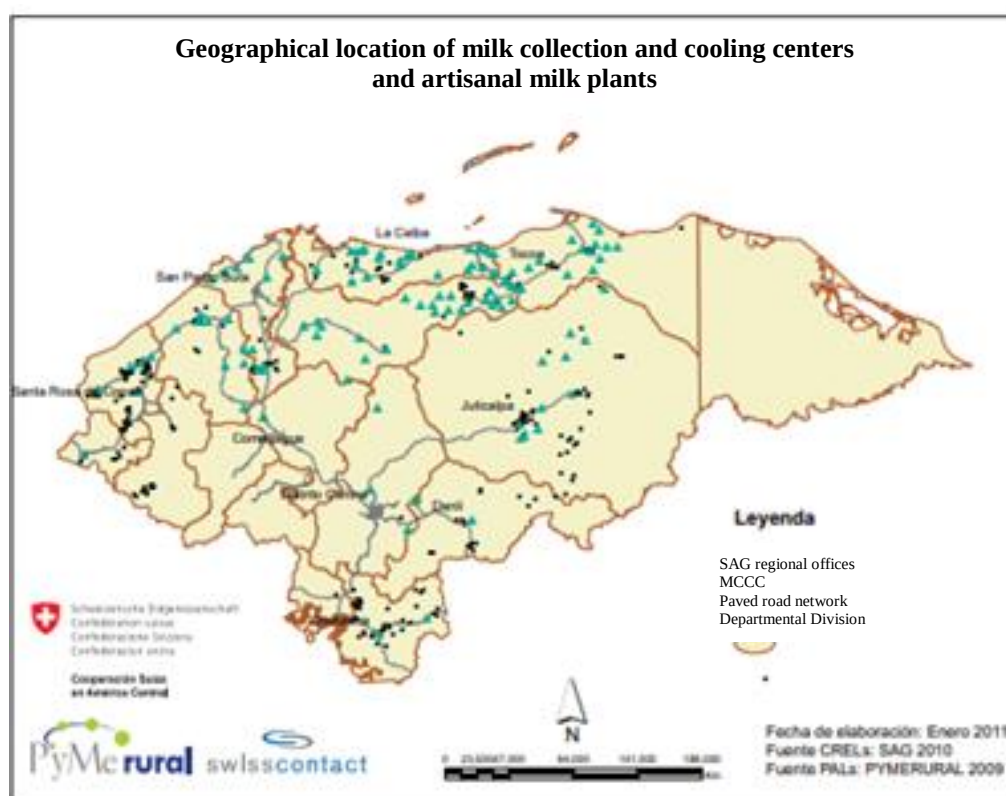


Figure No. 6 Geographical location of artisanal milk plants in Honduras

Source: (Canu, Wretlind, Audia, & Tobar, 2018).

4.1.2 Conditions of the artisanal industry

The artisanal industry is defined as those small companies that process milk and produces cheese, butter, and curd with lower quality than large industries because it not shares the

same conditions in their manufacturing. The artisanal processing is carried out more frequently in rural areas, the sales are local and national, the raw material is collected from small farmers or intermediaries, its operation is carried out without government link, and it is known as the informal sector of dairy production. (Molina D. , 2010).

The rural and urban industry conditions depending on the available resources and the pace of the population life. In the market analysis conducted by (Molina D. , 2010) it is stated the prices of dairy products according to the time of year, being higher in summer and lower in winter; This is due to the droughts and floods that the country faces every year. The manufacturers sell between 0.36 to 0.45 US \$ / liter, while the artisanal plants between 0.13 to 0.40 US \$ / Liter. The sale of artisanal dairy products is greater in the urban area because there is a greater consumer population.

Among other differences found in the dairy chain analysis in Honduras, refers the urban areas as the main large industries characterized to have quality standards as a priority in production due to the competitiveness and the higher interest to export. This fact is not considered in artisanal industries due to in large industries the raw material is acquired with a higher price and is manipulated under bacterial control standards and an adequate fat content (Molina D. , 2010).

There are different causes that affect the artisanal processing conditions in Honduras and over the world, producing the lack of hygiene and manufacturing quality; among them, the lack of technical assistance, the lack of control and the lack of guidance established by regulatory bodies and institutions such as the Ministry of Health and the National Service of Agricultural Health. This factor is essential in the food market as well as the standardized processing requirements because it can get successful sales and the generation of new potential customers (López, 2008).

According to Enrique, Xavier, Castillo & Ganoza (2000), agri-food companies have accepted the challenge of internationalization, but it faces the need to increase the quality, the diversity and the image of their products, the incorporation of technology into their processes, the investment in research and development, the advancing in marketing and the

management improvement through the training of its workers. Those points can help to control and to keep the efficiency in the processes, since it includes the stakeholders and the consumer as the main reason to achieve quality production.

Regarding to the establishment where the production process takes place, 46% of the artisanal industries have block walls and 68% cement floor. In the research carried out, it documents that 66% are not registered in the National Agricultural Health Service, and only 55% have a sanitary license, issued by the ministry of health. (Canu, Wretlind, Audia, & Tobar, 2018). This fact has a disadvantage on the industry development since there is lack of hygiene and poor structure conditions in its processes, therefore, the competitiveness is lower.

The artisanal manufacturing is carried out by operators whose have acquired knowledge through the experience. Due to the low economic capacity and the lack of technology in the operations of the artisanal industries, the production is incompetent in comparison to the large industries that have sophisticated machines with high technological level. Because of this, there have had the need to implement a training program for the artisanal operators about the products manufacturing to ensure and to promote the productivity and profitability (Canu, Wretlind, Audia, & Tobar, 2018).

4.2 Production

Over the years, the industries in Honduras have faced the country economic crisis and the climatic instability, however, dairy production has maintained its raw milk production standard between 500 and 650 million liters per year, approximately 1.7 million per day. The production is used for own consumption and to export to countries such as the United States, Mexico, and Central America. (FENAGH, 2013). This fact stated that the production of milk in Honduras is a profitable market in the agroindustry since it represents an opportunity for the development and national improvement.

A fact that increases the hope of the small livestock industries is that in recent years the demand for dairy products has been increased in the country, which motivates to acquire more raw material for manufacturing. This fact was determined in the analysis of the dairy

sector where it is mentioned that the livestock herd in Honduras increases year after year, where it is estimated that in 2008 it exceeded 2.5 million head of cattle with a production of 3.8 liters/cow and for winter it rises to 4.4 liters/cow. (Molina D. , 2010). The increase in production can be a fact that allows the transformation of food products and the promotion of foreign investment to develop actions that strengthen the Honduran agro-food sector in its processing stage.

The artisanal industry production in Honduras represents a factor of great importance in the country economy since as it mentions Canu, Wretlind, Audia, & Tobar, 2018, the production in Honduras indicates that between 36% and 40% of the milk produced is processed by the artisanal cheese factories, representing a volume of 180 million liters of milk that in relation represent a production of more than 27,500 tons of cheese per year. This fact indicates that if processing standards are established in the artisanal industries, a large percentage of quality dairy products can be produced.

4.2.1 Description of the artisanal cheese process

The artisanal cheese manufacturing is a process carried out for human consumption that requires a series of methods using the milk as raw material and that unfortunately generates waste in its processing. In researches carried out, it has been determined that the whey is a by-product of cheese and butter production. (Ávila, Cárdenas, & Medina, 2000). This fact has raised the interest of the search on models that reduce the polluting waste and the improvement of the process in general way. In the Figure No. 7 ,the method used in Honduran artisanal plants is specified, analyzing the design of the environmental management system.

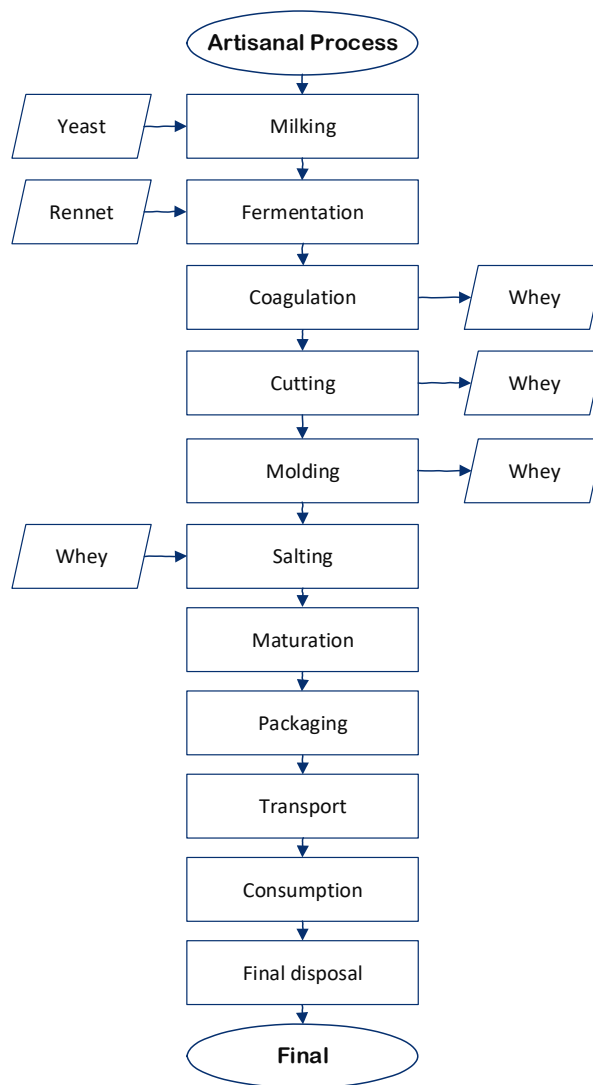


Figure No. 7 Artisanal manufacturing cheese process

Source: (Muller NIGRI, 2014)

The artisanal cheese production in Olancho begins with the previous evaluation of the raw material (milk) to get a product that meets the quality standards. The first step is to clarify where it is about reducing the dirt that milk contains; then the milk is received in containers and the evaluation is essential through an organoleptic sensory analysis (smell, taste, and color) which consists on filtering the milk in a blanket or fine strainer, carrying out the preheating of milk at 38 ° C. degrees centigrade and milk skimming (Rubí López, 2011).

The cheese is one milk derivative and it can be produced from several types of proteins, fats, minerals and vitamins that enrich human health. According to (Mora, 2010) It is important to manipulate the raw material in optimal conditions for its use and thus guarantee safety conditions for consumers. On the other hand, during the cheese production, the amount of humidity determines the type of product that it is desired to produce.

Once the milk reaches the quality standards determined by the cottage industry, the next step is the pasteurization of the milk, which consists on heating the milk until it reaches a temperature of 65 ° C; this procedure takes about half an hour and then it can cool until it reaches 38 ° C. According (Tayde Yesyt Gutierrez, 2014) The goal is to eliminate all pathogenic microbes. Then add the necessary calcium chloride to recover the calcium lost in the heating process. Once the calcium chloride is added, the rennet tablet is dissolved with water and salt, stirred for about a minute, this procedure causes the coagulation of the milk proteins. (Rubí López, 2011).

After that it is necessary to wait approximately 45-60 minutes until the milk reaches the desired consistency. In this step, the solid portion is completely separated from the liquid by sedimentation. Then, the curd is cut into small squares with a knife or palette and stirred for a couple of minutes. To generate the consistency, the curd heats to 40 degrees centigrade and it rest for approximately 10 minutes. Then the process of draining the curd follows, this step is important since the can be used in other process, however, in the artisanal industries it is discarded in the drains. (Rubí López, 2011).

Salt is then added on the upper side, and after approximately five hours the cheese is turned again, and more salt is added to the other side. The resulting whey is collected and used in the next cheese production (Muller NIGRI, 2014), the curd is milled in a manual mill and the cheese is received in a plastic or steel tray. Finally, it is refrigerated at four degrees Celsius (Rubí López, 2011). The cheese is packed and transported to the different points of sales where it is delivered to the final consumer.

4.3 Opportunities for environmental improvement

Based on dairy industry evaluations, it has been determined, there are environmental impacts in the activities carried out during the artisan cheese process in Honduras and over the world; a factor that involves the process in-depth of the critical points evaluation and the determination of preventive methods related to the improvement opportunities. These aspects are included within the environmental management with the objective to quantify and to make an environmental performance evaluation of the product or process from “cradle to grave” and thus to help the decision-makers to choose between alternative products and processes (Baumbach, 2013).

In the analysis carried out in the small dairy industries located in Olancho, Honduras, it was determined there are polluting factors which include a negative environmental aspect and therefore affect the conditions of the air, water or soil. Table No. 3 specifies in detail the aspects that were detected in previous researches and how it polluted the natural resources. The environmental impacts identified mainly affect the water resource, so it is essential to search for alternative methods of managing this resource, included in environmental management.

Table No. 3 Identification of environmental aspects and impacts in the artisanal cheese process

Element	Functional Unit	Environmental Aspect	Environmental Impact
AIR	Machinery and equipment	Noise	Air pollution
	General Machinery	Heat losses	Contamination by fuel
WATER	Milk's reception	Leak	Water pollution
	Pasteurization	Use of water resources	Decrease in resource
	Coagulation	Generation of whey	Water Pollution
	Cutting	Generation of whey	Water Pollution
	Packaging	Solid waste	Water Pollution
	Maintenance of machinery	Use of chemical substances	Water Pollution
LAND	Packaging	Generation of solid waste	Land Pollution
	Maintenance of machinery	Use of toxic substances	Land Pollution

Source: (Tayde Yesyt Gutierrez, 2014)

The author (Estévez, 2013) argues the cheese processing is one of the main sources of environmental pollution since during the manufacturing procedures there are spills of product, raw material not recovered and leaks that damage due to liquid effluents, solid waste and atmospheric emissions. It has been estimated that 90% of the COD of the wastewater of a dairy industry is attributable to components of milk and only 10% to the foreign dirt of the same. This pollution is caused by the high levels of nitrogen and phosphorus and high content of organic matter.

Among the sources of environmental pollution in the pasteurization and cooling activities in the milk process are the spills and product losses, high protein content, whey, high content of particles, waste of soaps, disinfectants, detergents and water (Estévez, 2013). During the artisanal cheese process, the sources of pollution damage the quality performance and reputation of the artisanal industry, representing one of the reasons to make the proposal and get the efficiency and profitability required by the organization.

The by-products unloading and the waste without previous treatment has triggered a polluting load since the receiving body has been the close rivers to the artisanal industries. This soil contamination in Olancho, Honduras occurs during several process caused by the generation and release of toxic substances. On the other hand, the phenomenon that affects the aquatic life and health of the human being is the water pollution, which occurs in different activities of the dairy artisanal production (Estévez, 2013).

4.4 Proposal for an Environmental Management System in the dairy industry

The artisanal dairy industry, according with the characteristics and the importance of the socio-economic development with the productive process, has begun the development of goods and services production without simultaneous waste generation; however, as (Muñoz & Muñoz, 2007) says, the planners give a little importance to consider an uneconomical developing form and insufficient space to deposit undesirable materials. Despite this, currently, the cleanest production has meant the application of preventive and integral processes and resources to reduce the risks where the human being and the environment in the dairy industry are involved.

Due to the importance that dairy industry represents at a production and consumer level, it decided to make a proposal for an environmental management system that can be modified by each organization depending on the process needs, adapting its own models without losing the objective at the collective level. This environmental management proposal is oriented to the prevention of possible future problems and the improvement of the situation that currently affect the organization. The proposal is based on dairy processing of Olancho state, Honduras, however, it can be applied by the management of small and medium enterprises in coordination with their own objectives. The purpose of the environmental management proposal is to reduce the pollution produced by the whey in the production of artisan cheeses.

The Environmental Management System model is based on the prescriptive ISO 14001: 2015 and the PDCA methodology, which includes a systematic approach related to the continuous improvement. To make the environmental management proposal, several aspects were taken as reference; among them:

- a) The proposal assumes there is no strictly clean production previously.
- b) The previous analysis was carried out according to the artisan cheese process situation in Olancho, Honduras.
- c) The proposal can be modified according to the organization needs (implementation time, alternative methods)
- d) The proposal faces the industrial pollution in a preventive and corrective way.

e) The proposal is based on the ISO 14001: 2015 standard.

Objective:

Proposing preventive strategies and methodologies to reduce the waste generation in the artisanal cheese process (whey), increasing the profitability, recognition, and quality of the artisanal dairy industry.

1. Context of the organization

Purpose: Determine the risks and opportunities for improvement through the general internal assessment of the artisanal dairy industry.

The general analysis of the artisanal dairy industry consists on the inspection of production activities, with the aim to identify those that influence the environment directly and indirectly. The evaluation includes eco-design, understood as the integration of environmental and the product's life cycle (Lewandowska & Matuszak-Flejszman, 2014).

Activity:

I. Analyze the dairy environmental conditions where the production manager and collaborators must be responsible for the production plant and the information gathering.

The analysis will consist on:

- General evaluation of the internal process (physical plant, human resources, stakeholders, organization flow charts, work culture, artisanal cheese processing activities).
- Evaluation of the legal, social, economic and technological standards compliance (work permits with acceptable date).

- General assessment of the environmental conditions related to air and water quality, availability of natural resources and biodiversity directly and indirectly used in the artisanal dairy process, identification of sites with high materials consumption and emissions.

The general evaluation will be reflected in the template of industry environmental conditions. As it is presented in the Table No. 4. to supervise in a general way, it will be assigned a score of 1-5, considering 1 as inadequate condition and 5 as adequate condition.

Table No. 4 Industry Environmental conditions

Industry Environmental Conditions		CODE	
		REVISION	
		No.	
Factors	Qualification (1-5)	Observations	
Process plant			
Production materials			
Process activities			
Air quality			
Water quality			
Land quality			
Technological resources			
Standars compliance			
Legal requirements compliance			
Waste management			
Employee performance			
Reviser	Date	Signature	

Source: Own elaboration

1.1. Scope of the environmental management system

The scope definition of the environmental management system will be developed based on the risks and opportunities detected in a general way, relating the production plant and the environmental condition and considering the processes involved in the artisanal cheese production. The scope will be defined by the strategic direction and the process experts in

accordance with the ISO 14001: 2015 standard, defined as “the declaration based on the activities that are intended to be improved” (ISO 14001:2015, 2015).

It is essential to know that the scope of the environmental management system should be available to all the staff and stakeholders (consumers, suppliers, employees), since the scope awareness will promote the effective activities development and the implementation of the management system environmental dedicated to the reduction of polluting waste such as whey.

Activity:

I. Establishing the scope of the environmental management system. The top management with the support of the production manager will be in charge to define the activities and processes that will be included in the scope. The factors should it considers are:

1. Deadlines
2. Limits and restrictions
3. Environmental objectives

2. Leadership

Purpose: To establish the principles of the environmental protection where the commitments are determined by the stakeholders in the dairy industry.

A fundamental part of the environmental management system is the stakeholder's responsibility and the commitment respect to the compliance objectives and the monitoring of the environmental policy, so that, the top management of the artisanal industry should ensure that all collaborators involved in the process have awareness about the continuous improvement useful in all activities that will be implemented.

Activity:

I. Define the roles and responsibilities for the optimal environmental management system execution. For it, the tool “responsibility assignment matrix” will be used due to according (Bacovia, 2011), is used to visualize the roles and responsibilities distribution within the area and project context. To develop the matrix is necessary to assign one responsible person for each issue of the environmental management system. As it is shown in the Table No. 5.

The matrix will be filled identifying the role of each collaborator and using the following letters:

A- Accountable: Person authorized to approve the outcome and outputs of the planned activities. Each activity must only be approved by one person.

R- Responsible: Person tasked with the performance of the planned activities.

C- Consulted: Person whom the progress of work shall be consulted. It is preferable that the process specialists obtain this position due to the closeness in production and their knowledge.

I- Informed: Person kept informed about the progress and outcomes from the concerned area. There may be several persons with this relationship in the matrix.

Table No. 5 Responsibility assignment matrix

Environmental Management System					
Update date:					
Work Breakdown Structure code	Function/ Task	Role A/Team	Role B/Team	Role C/Team	Role D/Team
1.1	Task 1	R		A	
1.2	Task 2	A	C	R	
1.3	Task 3	C	I	R	A

Source: Adaptation (Bacovia 2011)

2.1 Environmental policy

The environmental policy engages the issues of environmental protection that the artisan dairy industry desire to implement. Within the environmental policy, will be an emphasis on the improvement opportunities detected in the previous analysis (water quality, recycling, air quality, protection of ecosystems). Other aspect to consider is the wording of the environmental policy should be clear since the environmental objectives depend on it.

Activity:

I. Define an environmental policy that provides a frame of reference for the objectives establishment in relation to the protection of the environment.

3. Planning

Purpose: Define the environmental management planning through the analysis of the process, risks and improvement opportunities related to the environment in the dairy industry.

The planning consists on the activities to be followed in the environmental management implementation to counteract the improvement opportunities in the dairy industry process (spills of milk whey and milk) and to determine environmental impacts in the artisanal cheese production. For the identification of activities, the input and output elements associated with current activities, products, and services must be analyzed. (ISO 14001:2015, 2015).

In planning, the lack of resources necessary for the management implementation, linguistic barriers and new technologies must be considered and adopted. The environmental aspects related to the artisanal process should also be considered, such as water discharges, the use of raw materials and natural resources, discharges of whey, generation of waste and the use of production plant.

Activity:

I. Proposing a committee composed by the production supervisor, process manager, and one top management representative with the purpose to discuss the possible threats, advances, and solutions, before and during the environmental management implementation using the matrix of responsibilities.

II. Design the eco map for water consumption and wastewater discharges. The ecomap is a simple tool that will help to the industry to identify and prioritize environmental problems (Comisión para la Cooperación Ambiental de América del Norte, 2013); It consists on drawing a map of the process plant where the areas with liquid spills and high water consumption are observed and identified by symbols, as it is shown in the figure.

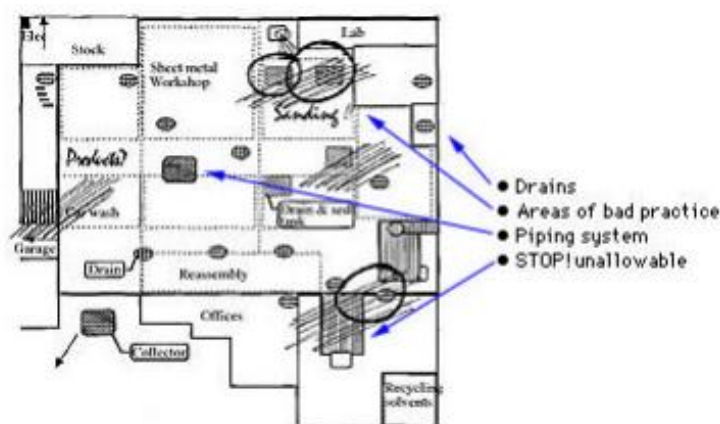


Figure No. 8 Example of eco map design

Source: Adaptation (Comisión para la Cooperación Ambiental de América del Norte, 2013)

III. Develop the life cycle analysis which is a tool for planning strategies, environmental objectives and its follow-up. (Haya, 2016) argued that, it is a tool used to recognize the environmental impact caused by the process/product throughout its life cycle (need detection, the conception of the idea, acquisition of raw materials, manufacturing, distribution, consumption, waste management and final disposal). At each stage of the life cycle, it should be detailed if there are inputs from the process (energy, milk, rennet) and outputs (liquid effluents such as whey, water, air emissions, solid waste, other emissions, useful products). An example of the template to be carried out is shown in Table No. 6.

Table No. 6 Life cycle analysis

Life cycle analysis		CODE	
		REVISION	
		No.	
Process Activities	Are there inputs or outputs from the process? (YES/NO)	Observations	
Milking			
Fermentation			
Coagulation			
Cutting			
Molding			
Salting			
Maturation			
Packaging			
Transport			
Consumption			
Final disposal			
Supervisor	Date		Signature

Source: Own elaboration

VI. Identify environmental impacts through the "methodology of identification and assessment of environmental impacts" of the artisanal cheese process.



Figure No. 9 Methodology of identification and assessment of environmental impacts

Source: Adaptation ((Mijangos Ricardez, 2013)

Proposal: Once in the life cycle analysis, the inputs and outputs of the process have been listed, the identification of environmental impacts will be showed through the "Simple Control List" methodology, which consists on a list of environmental variables with the environmental impact that dispute about the possible conditions that arise during the process and thus this fact must not be omitted particularly in the analysis.

It's easy use, low investment costs and quantitative results allows making the optimal decision and it is considered the best option for the environmental aspects identification in

the dairy industry (Mijangos Ricardez, 2013). The simple checklist should consider environmental aspects, such as water, and soil, as shown in the Table No. 7.

Table No. 7 Simple control list

Environmental impact identification				
Organization: Dairy artisanal industry				
Responsible:			Date:	
Process: Chesse production				
Check List: complete with an "x" in the corresponding space.				
Environmental impact	Yes	Maybe	No	Observations
Water conditions				
Does the water conditions are optimal for the washing process?				
During the cheese process, is there a liquid spill?				
Is there enough water during the cheese process?				
Does water undergo alterations during the process?				
Does the process has a liquid spill through the public drainage system?				
Does the environment receive whey discharges during the process?				
Is there any chance to recycle the water?				
Land conditions				
Does the process produce ground saturation?				
Does the land suffer changes after the spills of whey?				
Does the process produce land pollution?				

Source: Adaptation (Mijangos Ricardez, 2013)

Once the specific control lists have been documented, it proceeds a detailed description about the factors considered in the observations as generators of an environmental impact. The description will allow determining if the aspect is positive-negative; recoverable - irrecoverable; direct- indirect and permanent- temporary. This process is better known as the characterization of environmental impacts.

The purpose of the environmental impact assessment is to determine the significance in normal and abnormal process conditions. The parameters of the valuation allow building the scale of priorities easily, which will help to carry out the corrective actions of the operation. The significance of the probability and severity will be considered in the calculation of the priorities, following:

Probability: Based on the frequency in which events occur and the environmental aspects are generated, the probability will be the sum of the frequency (sporadic, frequent, assiduously), permanence (temporary, permanent), and the feasibility of control (low, medium, high) (Montiel, 2015). Considering that the values that are granted to each of the factors must be between the values 1-10.

Severity: This factor determines the severity of the environmental impact and it is acquired by adding the resulting values of magnitude, intensity, hazard (low, medium and high category are considered) and reversibility (short term, long term and irreversible), which must be in the range of values 1-10 (10 is the highest and 1 the lower) (Montiel, 2015). The formula below shows the correct way to obtain the significance of the impacts found:

$$\text{Significance} = \text{Probability} * \text{Severity}$$

Formula No. 1 Significance of the impacts

Source: (Montiel, 2015)

3.1 Legal requirements

Top management has the obligation to check the legal requirements necessary to follow the whole dairy process related to the environment. Another important aspect is to define the requirements, the governmental entities, and the national and local regulations of the process. In case of the legal requirements do not comply with the specifications of the environmental management, it could have repercussions in the implementation of new strategies. For that reason, it is essential to have awareness about the documents necessary to implement the environmental management system.

Activity:

I. Identify the environmental legal requirements that ensure national and local compliance. For this, the top management will oversee, verifying the description of the applicable requirements in the dairy industry and trying the effective communication. The evaluation of legal requirements should cover the following aspects:

- The environmental management system implementation.
- The execution of the process activities.
- The establishing of new process activities.
- The process updates.

3.2 Environmental objectives

The environmental objectives should include all activities proposed by the artisanal dairy industry to abolish polluting waste. It is essential that during the establishment of the objectives be considered the precision, feasibility, and measurement since the lack of these criteria could negatively influence their compliance. On the other hand, the responsible for the objectives must take care about the environmental policy and the continuous improvement of the artisanal cheese process to make effective the tools suggested by the ISO 14001:2015.

Activity:

- I. Establishing of the environmental objectives, including sustainable development, process quality, and environmental policy.

4. Support

Purpose: Ensuring the efficient development of the artisanal cheese process and the respective documents related to the maintenance of resources.

The resources refer to the elements for the optimal development of planning activities in relation to the environmental management in the artisanal dairy industry, among which are the supplies, equipment, infrastructure, human and natural resources. The collaborators are an important part in the management system development, since the awareness of the current industry situation, the commitment of the legal requirements, the planned activities and the established objectives can only be known if there are trained human resources program.

4.1 Competence, training and awareness

The communication is a fundamental part of the environmental management system implementation since if the stakeholders know about the objectives and environmental policy, could be generated a significant performance in the process, detecting an internally and externally improvement opportunities in the artisanal dairy industry. On the other hand, there should be a constant feedback based on real events which indicating the process status and the improvement actions.

The internal communication should be transmitted through the procedures and instructions of the environmental management system using the technology or dissemination material available. The disclosure of the environmental aspects and the commitments proposed in matters of pollution prevention are part of the internal communication. The external communication includes the stakeholders of the process (suppliers, distributors and government entities), therefore if any of them are interested about the information gathering, it should be channeled through the top management of the artisanal dairy industry.

In the artisanal cheese process, the information must be documented by the production, quality and top management staff and should be notified to keep it in safe manner to the collaborators, with the aim to do the evaluating compliance about the environmental management objectives at the end of the implementation. For this activity, it is proposing to define the labeling of the documents and their registration.

The dairy industry must to ensure that employees have awareness about the process developing and to keep focus on the training program or the appropriate experience to be able to determine the needs related to environmental aspects that arise during the implementation and in that way to take effective actions in case of a threat or risk appears in the artisanal cheese process.

Activity:

- I. Making a list of the necessary resources for the environmental management implementation in the dairy industry.

- Human Resources.
- Hygiene material (hairnet, apron, special shoes, mask, gloves).
- Office supplies (printer, paper, pens, computer).
- Material for process development.

II. Develop the communication process, including the technological information in case of updating of proposals, objectives, and activities. As it is shown in the Figure No. 10.

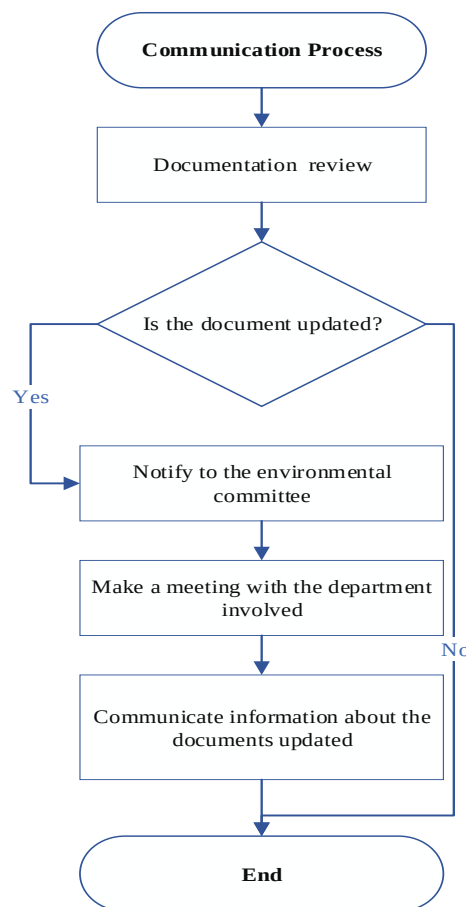


Figure No. 10 Process communication of documents updated

Source: Own elaboration

III. Making a checklist, labeling, and the documents registration that ensures the environmental management system assessment. This guarantee that the documentation can be reviewed and modified any time as required.

For the registration of documents, it is recommended the use of a header (logo, code, revision, document title, date of preparation and page number), objectives, scope, the development of activities, updates, registration of copies and the signatures of the author. It is important that each document has the guidelines to ensure the control and the order during the registration of the documents.

The documentation should be organized and then checked in meetings where the committee established in the dairy industry can collaborate to achieve their correct evaluating. In each meeting should be a leader, an operation expert and a person from the top management or representative. The template of the documents could be modified; however, it is recommended to use the same for all documents registered.

For the information collected, a person in charge will be responsible to control the environmental management system, to validate and communicate when the documents have new strategy version. Then, the documentation should be notified with the updates; for that, it is recommended the use of the documents update template Table No. 8.

Table No. 8 Documents update template

Documents Updated				
Document	Revision	Date	Modifications	Cause of modification

Source: Own elaboration

According to ISO 14001: 2015, Regarding to the obsolete documents, it must be archived for a minimum of one year. It is important that each document registered has a specific labeling that allows the easily search. The documents that must be documented and disclosed are:

- Environmental policy
- Objectives
- Production processes

- Operating instructions
- Legal requirements

5. Operation

The artisanal dairy industry involves a specific process that require operational control to get success in their results, that is why to ensure the effective development of procedures, it is necessary to design a work plan that prevents the adverse results in the objectives settled at the beginning of the environmental management and it allows continuous verification during and after production.

The operation planning and their implementation is essential to mitigate the environmental impacts that arise in the artisanal cheese process, such as the spill of whey in the soil and drains. During the planning, the dairy industry should to establish the control degree which it will exercise over the processes and the objective for the environmental management system implementation (competition, management of resources, improvement opportunities available and the profitability). The planning can include activities from the first phase of the process, including inputs, operation, transport, delivery and the final product (Montiel, 2015).

Activity:

I. Establishing the process design using the flow chart to ensure the quality product and the efficient environmental management implementation. For this it will be use the standardized operating procedures for sanitation (POES), describing the sanitation tasks that must be applied before and after the manufacturing operations. (Programa de Calidad, 2017).

- Sanitation process of production material.
- Sanitation process for deposits and collect of waste materials and finished products.

II. Implement 5's methodology: The creation and maintenance methodology of well organized, cleanness, high effective and high-quality workplace. Its result is the

effective organization of the workplace, reduction of work environment, elimination of losses connected with failures and breaks, improvement of the quality and safe work. The philosophy is constituted with the acronym of five Japanese words, seiri, seiton, seiso, seiketsu, shitsuke (J. Michalska, 2007).

- Sort: Refers to the classification of the material necessary and unnecessary for the environmental management implementation in the artisanal process, for which the instruments should be categorized and the unnecessary should be eliminated.
- Set in order: Focuses on the need to maintain the workplace in order. Tools, waste, equipment, and materials must be systematically arranged for the easiest and the most efficient access.
- Shine: Refers to clean each tool used before, during and after the craft process, ensuring that everything is kept in order and in the right place. This activity includes production tools, waste and work areas.
- Standardize: The implementation of the methods and instruments standardized allows the order in the dairy cheese process, as well as the control of the strategic management proposals. Methodologies that ensure the quality of the product should be included for the standardization in the dairy process.
- Sustain: The standards implementation requires the awareness the discipline of each employee to be consistent with the new regulations, therefore it is important to maintain the training program, the process assessment and the environmental management assessment.

III. Implement the waste management program which includes the specific identification of spill and whey collection from the point of generation to its temporary storage and subsequent collection.

1. Identify the operations areas that produce wastewater and whey oil spills with the help of ECOMAP and the life cycle analysis documented.

2. Identify the causal agents and the factors that produce the generation of waste in the artisanal cheese process with the support of the cause and effect diagram, which is better known as Ishikawa diagram and is used to identify and display the possible causes of a problem, using the six categories of the "Ms" as their branches: Machine, Manpower, Materials, Methods, Measurements and Environment (Ron S. Kennet, 2014).

For its implementation, the problem must be developed as in the diagram shown in the Figure No. 11, in each of its branches the possible causes related to the “Ms” should be placed, identifying as the root cause the one that repeats more times.

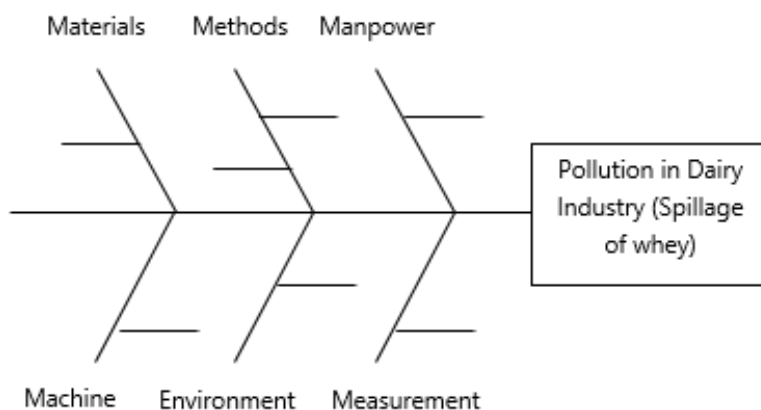


Figure No. 11 Example of Ishikawa Diagram

Source: Adaptation (Ron S. Kennet, 2014)

3. Collecting the whey in the primary outputs detected to allow the storage and the reusable product use for a future process. The optimization of the whey collection system must have the purpose of preventing the product from reaching the drains or soils that can be contaminated (Pacurucu, 2011).

For the whey collection, it will be necessary to transport the product from the production area to the storage, the acquisition of buckets and other tools, however, according to (Pacurucu, 2011) the acquisition of a sanitary pump to transport the whey would reduce the total time for the collect waste and production time. During the transport, it is important to take care to avoid spillage of whey because it translates into a pollution load of the effluent.

Establishing whey management in the artisanal cheese manufacturing, depends on the size of the dairy industry and the financial resources available for its implementation. As the first step, it will be the collection of milk whey; Once this is stored, it must be selected the use that will be given it according to the costs and materials required for its implementation, among which can be mentioned are:

1. Use of whey for the own or external feeding of cattle and porcine, for this it is necessary to incorporate the whey collection system and the planning of the product distribution.
2. Use of whey to elaborate new products such as protein concentrates, alcohol, lactic acid, glucose syrup, lactose and lactates, fermented milk drinks (Corantioquia, 2016). Commercial applications of whey are used in the formulation of functional foods such as ice cream, yogurts, sauces and products recommended for dieting.

Another application of whey protein concentrate (WPC) is the used on the diet of athletes, mixed with amino acids that are promoters of muscle growth, tissue regeneration and replacement of muscle mass (Cebrián & Gutierrez, 2016).

3. Use of whey for the generation of biogas to produce energy. Some of the benefits granted to biogas are: lower energy consumption in the process, reduction of greenhouse gas emissions, reduction of waste in the artisanal industry, production of agricultural biofertilizer and greater profitability (Cebrián & Gutierrez, 2016).

5.1 Emergency preparedness and response

For any process operation, there is a risk to face as an emergency action and that it can prevent the follow-up of the planning and the quality of the final product, so it is necessary to generate corrective and preventive measures that issue an emergency plan to face with the negative situations that arise in the process. On the other hand, the emergency plan has the function to direct, execute, evaluate and remedy the development of the planning activities, in this way in each update, the proposed emergency plan should be also evaluated.

Activity:

I. Develop an emergency plan and to carry out the corrective actions. The equipment must be constituted by:

- The general manager or the administrative head of the industry.
- Production manager.
- Operator
- Environmental supervisor.

If there is no representative of each area, the position must be granted to one of the collaborators of the dairy industry. The representatives must have awareness about the environmental management situation and how to use all the internal resources, as well as the responsibility to attend the meetings periodically to define the emergency process and prepare the updates of the documents.

Establishing an emergency process that generates preventive and corrective measures in case of accidents in the dairy industry must consider the welfare of the staff, facilities and the overall community. It is essential that the emergency plan details if are necessary the activities that must be carried out and the responsible in charge. The planning must be executed using the following measures:

1. Identification of emergencies: The responsible for the analysis and the review of the artisanal dairy process will detect the emergency situations during the process, then it will

be necessary to try to correct or modify those impacts to avoid the eventual occurrence and the negative affect into the environment.

For the first step, it is proposed to establish an operational risk matrix that, as (Palma, 2011) argued, has the aim to identify the possible risks of the process and quantify the repercussions that these may have in the future and to elaborate controls and contingency actions to combat each of these situations. The risk matrix is also used to determine the degree of exposure and the impact it represents, which can be from insignificant to massive.

The risk matrix implementation should consider the critical pollution points identified as the risk factors and each one of them should be assigned a weighting and incidence; According to this, it will be defined which of the risk factors could become an emergency and the actions that will serve as contingency should be planned (Albanese, 2012). The template used to archive the risk matrix should consider each of the mentioned factors, as shown in the Table No. 9.

Table No. 9 Risk Matrix

Industry Environmental Conditions				CODE	
				REVISION	
				No.	
Risk factor	Weighting	Incidence			Total (Weighting * Incidence)
	(1-10)	1	3	5	A
					B
					C
					D
					E
					F
					G
					H
Total customer risk					Σ A-H
Supervisor		Date			Signature

Source: Adaptation (Albanese, 2012)

For the risk matrix development, the weighting assigned will be calculated according to the significance of the environmental impact identified (1 = little significance 10 = very significant) and its incidence during the process. After that, the scores assigned must be

multiplicated each other, obtaining in this way the total risk that the environmental impact represents where their identification must be treated with greater urgency.

The communication during the emergency: The process of internal and external communication will be useful in case of a non-conformity is detected and it should be communicated to the responsible of the area, who must continue its follow-up until it is corrected. For the internal and external communication, it is recommended to have a list of key persons, contact details (fire department, red cross, cleaning services, spills, and pipes) to be notified in case of emergency.

2. Preparation and execution before emergencies: The person in charge to solve the emergency detected must to prepare a plan to monitor the activities carried out on the process and to determine the corrective actions, including the deadline of each activity.

3. Post-emergency actions: Once the corrective actions have been carried out, it will be analyzed if it is necessary to establish mitigation measures to avoid consequences in the environment.

4. Document registration: Each emergency in the process must be documented with the aim to get the environmental management measure through indicators and to verify the execution of the corrective actions according with the deadline established. The person in charge to document emergency activities will be the supervisor of the environmental management.

The emergency registration template with the respective corrective and preventive actions may change depends on the process needs which the responsible person required to tracing the management system. The annex 1, represents an example of the proposed fields to keep track and document the detected emergencies.

II. Define the training program about the prevention measures that must be put in place to avoid the process findings, the proper way to use emergency planning and the semesterly

response. The collaborators must have awareness about the roles and their responsibilities in case of an emergency occur as well as the measures that must be taken in case of first aid; for this, is recommended the aid simulations practice.

6. Performance evaluation

Purpose: Determine the monitoring of the activities carried out in the artisanal dairy industry and to verify the actions to face the environmental impacts of the process through operational controls.

The control and the operational assessment can mitigate the waste generated during the dairy artisanal cheese process and the environmental management for its compliance. The performance evaluation will make it possible to identify how many activities of the initial schedule have implemented and their effective quality improvement. On the other hand, it is essential that any non-conformity detected be identified and corrected in the least possible time.

Once the analysis process has been carried out, the internal audit will define which of the improvement opportunities is part of the non-conformities that may generate environmental impacts. The last step is the review by the management in charge to define the priority of the non-conformities of the process and the time it will require according to its importance.

Activity:

I. Prepare and analyze the indicators of the process to measure the compliance respect to the corrective and preventive actions implemented against the non-conformities detected and the improvement respect to the environmental impact.

In the evaluation of the indicators, it is important to consider the activities that imply a significant impact on the environment, the spill of whey and the energy consumption. For the establishment of the indicator, it is necessary to determine the percentage of pollution before the implementation and to compare it with the result, the difference will represent if the

improvement is positive or if it is necessary to monitor the negative factors in detail, such as shown in the Table No. 10.

Table No. 10 Matrix of indicators process

Before the proposal implementation	After the proposal implementation	Total
Percentage of whey spilled per liter of milk used	Percentage of whey spilled per liter of milk used	Reduction of waste (difference before-after)
15%	10%	5%

Source: Own elaboration

To determine the non-conformities indicators before, during or after the general inspection related to the environmental management, after that it must be analyzed the report that describes the preventive or corrective actions to be carried out, the detection dates, the deadlines to be possible their compliance, and their main causes. The indicator will determine the percentage of compliance of the corrective and preventive activities monthly as shown in the Table No. 11. If it has a higher incidence, it must register in the following month.

Table No. 11 Monitoring matrix of corrective and preventive actions

Corrective or preventive actions	It's completed?	Total	Observations
Activity 1	Yes	100%	In case of the level of compliance don't be 100%
Activity 2	No	0%	
Activity 3	Working on it	60%	
Total of compliance		53%	

Source: Own elaboration

As it is observed in the following Figure No. 12. This activity must have a responsible to communicate the report of non-compliance and the respective communication to the person in charge of the environmental management system, who must give instructions to the collaborators involved in the implementation of the corrective actions that will be carried out and solve before the next audit.

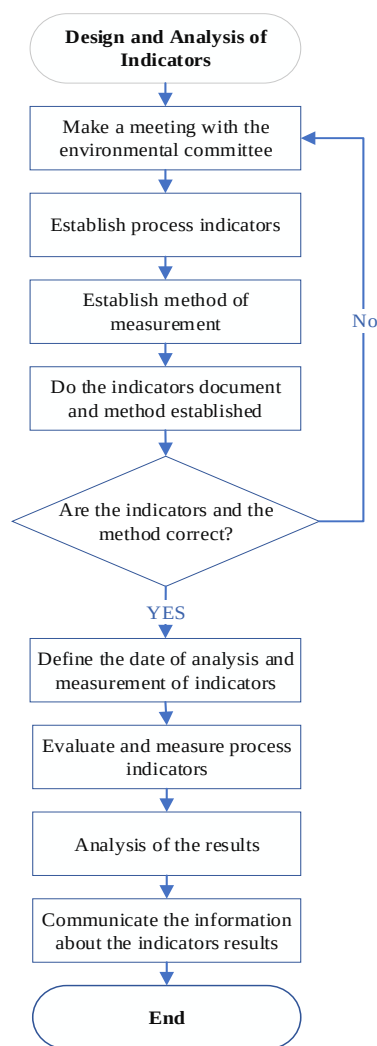


Figure No. 12 Process of establishing indicators

Source: Own elaboration

II. Perform an internal audit to evaluate each of the aspects related to the improvement opportunities previously found, the optimal compliance with the conditions of the raw material, processes, and the indicators measurement. To do this, the deadline and the planned goals to provide information about the environmental management system must be established.

The internal audit model should be defined by the top management in accordance with the impact produced by the process involved, considering the respective responsibilities of each collaborator and the series of activities to be implemented. Figure No. 13 shows the model that can be implemented in the artisanal dairy sector.

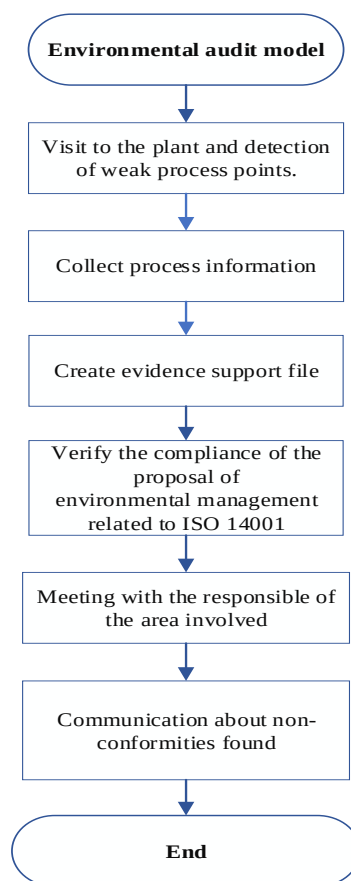


Figure No. 13 Process of an environmental audit model

Source: Own elaboration

The visit to the plant and the detection of weak points consists on the general review of the critical points that were found in advance. In this phase the auditors should to visit the places with the greatest environmental interest, such as the drains, emissions, and points of pollutants discharge to verify the effectiveness of the proposed environmental operation activities.

The information gathering consists on the status evaluation and the improvement of the area with the greatest environmental interest through the observing and the use of interviews as a direct means to obtain real results. Once the information is obtained (photographs, observation sheet, interview results), the evidence to generate the audit report should be documented.

The information will be used to verify and to get conclusions about whether the environmental management operations have had a positive result following the ISO 14001 standard and if it is necessary to implement new strategies with more ambitious goals. To complete the audit process, the report should be generated and communicated to those responsible for the artisanal cheese process.

III. Make a general review of the environmental management. The review must to include each of the aspects of the dairy industry assessment, the needs and expectations of the stakeholders and the opportunities showed in the audit. At the end of the review, it will be expected to get conclusions and valuable information to establish continuous improvement activities along the process. (ISO 14001:2015, 2015).

7. Continuous improvement

The continuous improvement is the base of the industrial success since it allows the involvement of new technologies and precise methods, which are essential to consider after the internal audit results, the performance assessment and the process updates required (Gómez, 2007). The environmental management system in the dairy industry will emphasize the continuous improvement in the innovation and the reduction of waste generated in the processing; therefore, the effective achievement considers the quality of tools, the documents and the implementation of corrective actions respect to the findings.

For the continuous improvement, several activities can be implemented to generate a positive effect on the performance and the quality of the environmental management system. According to (Gómez, 2007) the use of continuous improvement tools allows to maintain the interest of the personnel, the innovation in the process and the environmental management in search of the optimal strategic planning; for this reason, the following actions are proposed:

1. Develop training program
2. Define preventive actions for the non-conformities with lower priority.
3. Use posters and graphics to improve internal communication and the motivation of the collaborators

4. Develop an improvement plan for internal communication

7.1 Training program

Currently, organizations require more qualified personnel to positive influence and to make decisions about the key factors in terms of organizational effectiveness using personal training as an instrument. (Mauricio Robledo, 2015) describes it as "an investment that generates value and competitiveness". The development of a training plan dedicated to the improvement of processes and the proper use of tools can be an advantage for small dairy industries and it implies that all employees understand the key role of this function and easy adaptation to the changes that the environmental management proposal requires.

The environmental management proposal design involves to carry out activities to reduce the waste and the adequate operational control; however, to its development it is recommended to define the need to implement a training program, which is understood as the set of actions to prepare the collaborators in order to ensure the correct execution of each proposed activity and to ensure an efficient performance. (González, Guerrero, Ibarra, & Flores, 2016). Another important aspect is that the implementation of the training program will depend on the results of the performance assessment and the achievement of the objectives proposed in the environmental management.

The training program aims to develop skills and abilities on the use of material resources and the procedures that are modified or included in production to improve the overall industry performance (González, Guerrero, Ibarra, & Flores, 2016). According to the (Estrategia de emprendimiento y empleo joven, 2016) "The training plan refers to several actions designed as a complete itinerary aimed to develop skills into the employees".

For the effective development of the environmental management proposal, a training plan is presented in a simple and structured way that will consider the use of material resources, procedural updates, and the previously proposed activities. The model will focus on the regulations and operations required in the environmental management of the artisanal dairy

industry and it will have a cyclical monitoring of life that will depend on the performance evaluation at a productive level, as shown in the Figure No. 14.

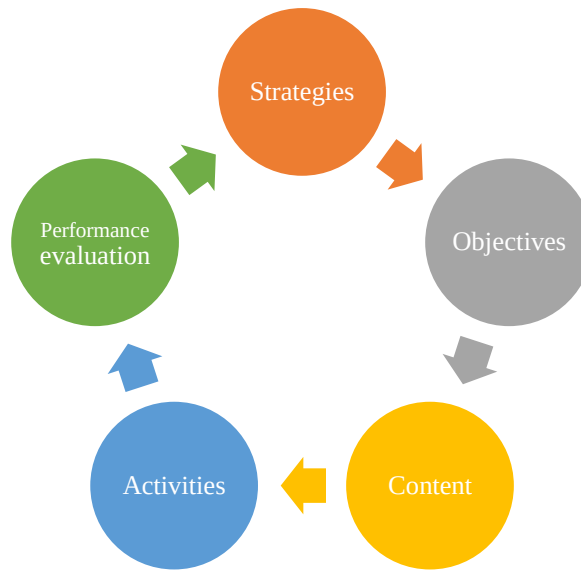


Figure No. 14 Training program activities

Source: Own elaboration

1. Strategy formulation

The strategy of the training plan will be based on the participation in modules of inductive, preventive and corrective information that encompasses each of the actions required to reduce waste in favor of the environment. For this, the need to promote training for the development of skills and knowledge should be previously identified, considering that it is the only way to transform, update and to improve productivity in the industry. (Siliceo, 2004).

2. Define objectives

The objective of the training plan will provide concepts and the necessary resources based on the proposal of an environmental management that generate a better performance by the collaborators in the dairy industry.

3. Thematic content

The thematic content of the training plan refers to the theoretical contribution and practical lessons that are planned to develop the collaborators awareness (Mauricio Robledo, 2015). As specified in the strategy formulation, the content will be divided into three large modules, each of it with topics related to the normative and operational approach.

Induction module: Consists on presenting the proposal of environmental management and the ISO 14001: 2015 standard as main tools to promote the reduction of pollution in the industry. The module will present in a general way the activities, the collaborators involved, the activities to be carried out and the importance in the dairy industry as an engine of competitiveness and quality.

Preventive module: Training on the activities and tools necessary for the implementation and the documents registration of the environmental management proposal. It includes the management of useful tools for documentation and the standardized monitoring of processes to cover all improvement opportunities.

Corrective module: Training in case of findings or inclusion of innovative activities during environmental management. This module pretends to show the corrective manage in case of emergency situations, showing the responsible to solve it and the activities should be done. It will be also useful in case of lack of competitiveness in the performance assessment.

4. Activities schedule and participants

The internal training will consist on a detailed explanation of the activities included in each module described, specifying the strategies and material resources that will be used in the environmental management implementation. Each module can be given as many times as the industry requires, considering as objective, the collaborators awareness about an adequate management, the necessary resources and the quality in the development of each activity. Below are the modules that should be taught in the dairy industry to get an environmental management improvement.

Table No. 12 Training program modules

Module 1: Induction	
Topics: ISO 14001:2015, Environmental management proposal	
Human Resources:	Production manager, top management
Materials:	ppt presentation
ISO 14001:2015 and their requirements.	
Importance of the environment management in the dairy industry.	

Module 2: Prevention	
Topics: Use of the environmental management tools	
Human Resources:	Production manager, collaborators
Materials:	matrix, ppt presentation
Simple control list presentation	
Responsibility assignment matrix	
Preventive actions matrix	
Risk matrix	
Matrix of the process indicators	

Module 2.1: Prevention	
Topics: Use of the environmental management tools	
Human Resources:	Production manager, collaborators
Materials:	matrix, ppt presentation, flow charts
5's methodology	
Ishikawa diagram	

Module 3: Corrective	
Topic: Environmental management tools	
Human Resources:	Responsible
Materials:	matrix, office equipment
Matrix management of corrective actions	
What to do in case of findings?	

Source: Own elaboration

5. Performance evaluation

The performance evaluation is the instrument used to measure the degree about the handling of techniques used in the environmental management proposal after the training plan (Mauricio Robledo, 2015). The person in charge of managing this instrument will be the manager or the management supervisor who will establish the resources, the evaluation criteria and the estimation of the labor obligations compliance of each collaborator.

Taking into account the above considerations, it is important to define that for the performance evaluation there are a large number of methods that can be implemented, however, for the dairy industry it is proposed to use the graphical grading scale method, which (Stephen & Judge, 2009) affirms "it is a scale that enumerates a series of characteristics and shows performance range for each one of them, to evaluate the employee, the qualification that best describes the degree of performance in each feature is chosen".

The performance evaluation is a useful tool to work in the organizational self-control, with this, it is hoping the results be the source of pertinent actions development to motivate the personnel and to acquire new concepts that generates the effective fulfillment of objectives and profitability in the industry.

4.5 Summary of the environmental management

The proposal of the environmental management system in the dairy industry summarizes the activities that must be developed in a methodological way to achieve an optimal production conditions for the environment and human beings. It is important to emphasize that the implementation will require the effort and dedication on the part of all collaborators in the organization, as well as the use of visual aids and structured diagrams specify step by step the activities from the beginning until the end of the process. The following Figure No. 15 represents the activities should be developed, tools and documents required to implement efficiently the proposal established.

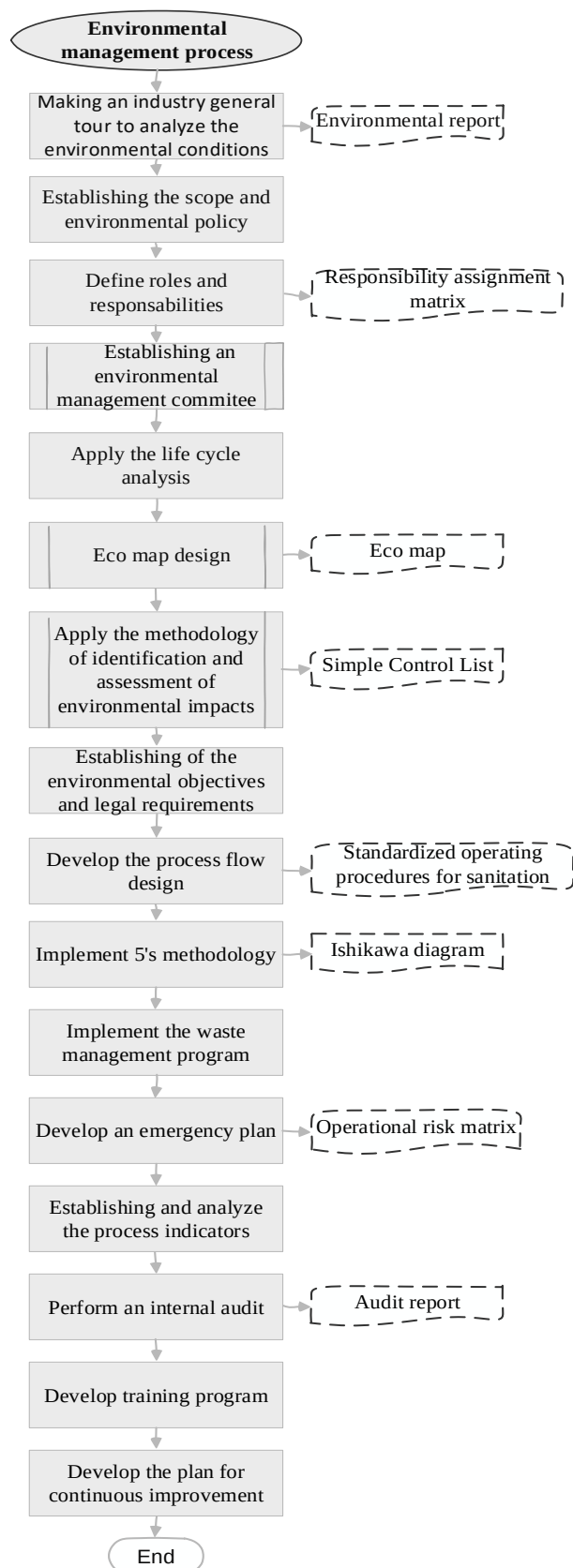


Figure No. 15 Summary diagram of the environmental management proposal

Source: Own elaboration

A summary table of environmental management is presented below, referencing the aspects that must be evaluated, those responsible for the activities and the necessary tools.

Table No. 13 Environmental Management Proposal

Environmental Management Proposal				
	Activity	Aspects to evaluate	Responsible	Tools
Context of the organization	Making an industry general tour to analyze the environmental conditions	Physical plant Human resources Artisanal cheese process Standards compliance Environment conditions	Production Manager and collaborators	Office equipment, Industry environmental conditions
	Establishing the scope of the environmental management system	Materials available Human resources Process activities	Top management and production manager	Office equipment
Leadership	Define the roles and responsibilities	Job positions Human talent	Environmental management supervisor	Responsibility assignment matrix
	Define an environmental policy	Opportunities for improvement	Top management and production manager	Office equipment
Planning	Establishing a committee dedicated to the environmental management implementation	Job positions	Top management	Responsibility assignment matrix
	Apply the life cycle analysis	Process activities Inspection frequency	Environmental committee	Office equipment
	Eco map design	Areas of bad practice: liquid spills and high water consumption	Environmental committee	Office equipment
	Identify an environmental impacts through the "methodology of identification and assessment of environmental impacts"	Life cycle analysis Process activities	Environmental committee	Simple Control List and formula of significance
	Identify an environmental legal requirements	Environmental laws Process activities	Top management	Office equipment
	Establishing of the environmental objectives	Previous analysis Available tools	Environmental committee and top management	Office equipment

Support	Making a list of the necessary resources	Resources available	Environmental committee	Office equipment
	Making and communication of the checklist, labeling and information gathering	Information collected: Environmental policy, objectives, processes, instructions and legal requirements. Communication process	Environmental management supervisor	Storage of documents, document updates template
Operation	Develop the process flow design: sanitation process of production material and sanitation process for deposits and collect of waste materials and finished products.	Artisanal cheese process Available tools	Production manager	Process flow chart
	Implement 5's methodology	Process plant Process activities Process tools	Environmental committee	Process and office equipment, cleaning products
	Implement the waste management program	Ecomap Life cycle analysis	Environmental committee	Ishikawa diagram and waste collection materials
	Develop an emergency plan	Job positions	Top management and production manager	Responsibility assignment matrix
		Process activities Corrective and preventive actions	Environmental committee and production manager	Risk Matrix, emergency contact list and office equipment
Performance evaluation	Establishing and analyze the indicators of the process	Non- conformities Activities with environmental impact Corrective and preventive actions	Environmental committee	Office equipment, indicators process matrix, monitoring matrix of corrective and preventive actions
	Perform an internal audit	Improvement opportunities	Top management	Environmental audit model and Interviews
	Make a general review	Progress of the environmental management systems Internal audit results	Production manager	Office equipment
Continuous improvement	Develop training program	Care of the environment New methodologies	Expert and Production manager	Training program modules
	Define preventive actions for the non-conformities with lower priority	Non- conformities	Environmental committee	Preventive actions template
	Develop an improvement plan for internal communication	Information and results collected New implementation tools	Environmental management supervisor	Office equipment

Source: Own elaboration

4.6 Recommendations

- Development of a monitoring program, documentation control, indicators and internal processes to get feedback about the improvement opportunities previously identified.

- Implementation of the waste management program to ensure the method that matches the needs and resources available for its effective development. The industry must determine the method that fits the budget and the achievable objectives.

- Implementing work organization initiatives such as:
 1. Delimiting areas of waste disposal, storage and production.

 2. Assignment waste containers to separate non-recyclable and recyclable material.

- Assignment of the scheduled reviews to determine through indicators if the process advances have been considerable in terms of the negative impacts previously identified.

- Making the environmental management implementation updates based on future modifications of the ISO 14001: 2015, since the standard guarantees the implementation of the environmental management in the small and medium-sized industries.

- Implementation of a computer system (database) to archive the process documentation.

- Preparing aid kits with the basic elements to face an emergency and a negative process impact.

4.7 Conclusions

The implementation of an environmental management plan aimed at prevention and corrective action involves a methodological process that must be detailed in relation to an international standard such as the ISO 14001: 2015 standard, since it uses measures to get the optimum environmental conditions based on the continuous improvement cycle PHVA.

The implementation of an environmental management system will allow the management of waste, it will contribute to the most effective production performance and will bring with it a series of economic benefits and business recognition.

A fundamental factor in the implementation of environmental management is the identification of immediate needs the industry currently faces. In the case of the small and medium-sized dairy industry, the environmental and process must be considered, among which are:

1. Training about the environmental care, the development of strategic plans for the process and the use of environmental management tools.
2. Poor environmental conditions for the sustainability approach due to spillage in the soil and water of the byproducts produced in the artisanal cheese process such as whey.
3. Generation of waste management programs.
4. Lack awareness about quality tools and absence of indicators to control and monitoring of environmental activities.

To ensure an efficient planning, improving an environmental management and the comply with the specific objectives, the environmental review should be considered as it provides a framework of the basic elements to gather information on legal requirements, operational processes, negative impacts and the documentation required.

In the environmental management implementation, the activities can be modified in relation to the industry needs, considering the information to get an effective performance such as the process tools to be used, the training of activities and the internal communication process. The success of the environmental management will depend on factors such as the structured integration of the personnel aimed to the fulfillment, as well as the monitoring, control, verification and correction of the proposed methods.

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4.9 Annexes

Annex 1

Corrective and preventive actions		CODE	
		REVISION	
		No.	
Non-compliance or problem detected			Date:
Origin			
Process			
Problem to analyze			
Proposed action			
Responsible:			Date:
Implementation assessment			
Responsible:			Date:
Assessment and Closure			
Deadline	Responsible for closing	Signature	