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Evaluation of Environmental Aspects and Impacts in a Company of the Animal Feed Segment

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Abstract: All human activity generates impacts to the environment, so it is important that organizations consider the implementation of an Environmental Management System (EMS). The overall objective of this study is to identify and evaluate the environmental aspects and impacts of an animal feed manufacturer, which will be the starting point for the future implementation of an EMS, in accordance to NBR ISO 14001:2015. The methods used were: qualitative approach, applied nature, exploratory research and unsystematic observation. With the results of this research, through the evaluation of the observed environmental aspects and impacts, it was possible to suggest some procedures for the mitigation of the aspects and impacts pointed out in this study. The identification of the environmental aspects and impacts were used to start the first step towards the implementation of the EMS.

Key words: environmental aspects and impacts, environmental management system, ISO 14001, animal nutrition; animal feed

1. Introduction

With the development of society and industry, environmental issues have been gaining more prominence by the day. It is important to remember that human development is related to good environmental practices, and it is thus indispensable to reflect on changes in our habits and in our work environment.

Concepts such as environmental preservation and sustainable development have been introduced to our daily life; therefore, the pressure from society and customers, as well as the increasing restrictions on environmental legislation and environmental bodies, have led companies to change their management model.

The search for environmentally correct practices is becoming popular in small, medium and large organizations in all sectors of the economy. When reflecting on their needs, companies should consider adopting an environmental management system that fulfills their duty of continuous improvement as a permanent commitment, controlling and conducting their production processes in order to preserve the environment.

The management of a process through an Environmental Management System (EMS) brings production, quality and satisfaction improvements to the people involved, resulting in a competitive advantage because the company is then in compliance with legislation, avoiding legal and financial problems while also transforming its brand into an ally of the environment.

In order to control environmental impacts, many companies implement NBR ISO 14001:2015, which establishes the main parameters for the implementation of an EMS from its planning to the effective monitoring of the improvements imposed. Apart from providing worldwide certification and recognition, this standard allows companies to develop their own

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solutions, meeting the requirements set out in their program.

The general objective of this study is to identify and evaluate the environmental aspects and impacts observed in the company as a starting point for the future implementation of an EMS, in accordance to NBR ISO 14001:2015, in an animal feed manufacturer located in Orleans, Santa Catarina, Brazil. In order to achieve this general objective, the following specific objectives were established: i) listing the theoretical assumptions about EMS; ii) identifying the main environmental aspects and impacts arising from the activities of the company; iii) recommending some actions to mitigate the impacts generated by the company, considering the future installation of an EMS according to ISO standard 14001:2015.

2. Theoretical Framework

2.1 Environmental Management Systems

The Industrial Revolution is referred as one of the decisive factors in the intensification of environmental problems, but other factors have also contributed to these problems. The waste generated by the population and activities such as fishing, transportation, commerce and services also play a role in environmental degradation, among other factors [1].

Environmental degradation has influenced the emergence of the concept of environmental management, which is nothing more than a set of actions that seek to understand and control/mitigate environmental impacts derived from the activities, products or services of any business organization [2].

The creation of an EMS in business organizations allows for a better management of their environmental aspects and impacts, helping to change the company's culture and therefore enabling continuous improvement of procedures and services [2]. According to Valle (1995) [3], environmental management systems aim to improve a company's activities through techniques that guarantee better results, thereby becoming a mandatory requirement for the NBR ISO 14001 standard. Barbieri (2007) [1] states that one of the benefits of the creation of an EMS is the possibility of obtaining better results with less resources, as a result of planned and coordinated actions.

Implementing an EMS is a voluntary decision of the company. This raises the question of which motives led the organization to opt for this system. It is noticed that companies are including the environmental question in their administrative strategy, as it consists of another advantage when facing a competitive market [4].

According to Barbieri (2007) [1], EMS must contribute, at first, so that the company acts in accordance with legislation. They must also be committed to promote constant improvements, allowing the company to overcome legal duties.

1.2 ISO Standard 14001:2015

ISO standard 14001 aims to specify the requirements for the implementation of an EMS which will allow organizations, regardless of their size, to develop sustainable practices in their activities, products and services [5]. The desired results in an environmental management system include [5]:

- Protection of the environment through the prevention or mitigation of environmental impacts;
- Mitigation of potential adverse effects of environmental conditions on the organization;
- Monitoring how the organization's products/services are designed, manufactured, distributed, consumed and disposed, using a life cycle perspective and preventing the involuntary displacement of environmental impacts within the life cycle;
- Increased environmental performance;
- Meeting legal and other requirements;
- Reaching economic and operational benefits that may result from the implementation of alternative solutions;

- Communicating environmental information to stakeholders.

The application of this standard may differ from one organization to another due to the context of the organization. The level of detail and complexity of the environmental management system will vary depending on the organization's context, the scope of its EMS, its legal and other requirements, and the nature of its activities, products and services, including its environmental aspects and associated environmental impacts [5].

The standard contains requirements used to evaluate compliance. Any organization wishing to demonstrate compliance with this standard must follow these steps [5]:

- Do a self-evaluation and self-declaration, or
- Seek confirmation of compliance by parties who have an interest in the organization, such as clients, or
- Seek confirmation of the organization's self-declaration by an external party, or
- Seek the certification/registration of the organization's environmental management system by an external organization.

An environmental management system is based on the Plan-Do-Check-Act (PDCA) concept. This cycle provides a repetitive process used by organizations to achieve continuous improvement. The PDCA cycle can be briefly described as follows [5]:

- *Plan*: establishing the environmental objectives and processes required to deliver results in accordance with the organization's environmental policy;
- *Do*: implementing the processes as planned;
- *Check*: monitoring and measuring environmental policy processes, including their commitments, environmental objectives and operational criteria, and reporting the results;
- *Act*: taking actions for continuous improvement.

The environmental standards and certifications are related to the productive process, to the relations with the community and to the relations with employees [2].

According to Ruppenthal (2014), labor relations, respect for human rights, the hiring of labor force and suppliers, environmental management and the nature of the product are analyzed in the production process. In the relationship with the community, the nature and focus of the promoted actions, as well as the social problems solved, are analyzed. With regard to employees, the benefits granted, the organizational climate, the quality of life at work and the actions to increase employability are analyzed.

1.3 Environmental Aspects and Impacts – ISO 14001:2015

ISO 14001:2015 [5] defines an environmental aspect as the element of the activities or products/services of an organization that interacts or may interact with the environment, while environmental impact is defined as an adverse or beneficial modification in the environment which results totally or partially from the environmental aspects of an organization. Environmental impacts can occur on a local, regional and global scale, and can also be direct, indirect or cumulative in nature [5].

There are many methods to determine significant environmental aspects and impacts; however, each organization has to establish their criteria according to their own context. These criteria may be basic or complex for the evaluation [5].

Criteria may be related to the environmental aspect (e.g., type, size, frequency) or environmental impact (e.g., scale, severity, duration, exposure).

Another criterion can also be used. These other criteria may include organizational issues as well as legal requirements or stakeholder concerns. The significance of the environmental aspect may result in one or more significant environmental impacts. When the organization's impacts are surveyed, however, there is an opportunity to create procedures to mitigate

them. The organization will thus achieve the desired results of its environmental management system [5]

The identification of environmental aspects and impacts is a major step in the planning of an environmental management system. One of the ways to identify them is the construction of a matrix relating these aspects and impacts, which will enable the classification and determination of their significance [6].

The methodology used in the present study was carried out through a modified matrix originally elaborated in 2007 by the Environmental Department (EP) of the Federation of Industries of the State of São Paulo (FIESP), who is in charge of environmental resolutions and the development of support materials. In this regard, and in accordance with FIESP (2007) [6], in order to determine the significance matrix of the environmental aspects and impacts, some criteria were considered as we can see in Table 1.

Table 1 Concepts to determine the intensity of environmental aspects and impacts [6].

Reach	Expresses the capacity of interference of the aspect/impact on the environment. It can be classified as local (when it is located in the facilities of the organization - Assign 1 point), regional (when the impact affects the surroundings of the organization and the region where it is located - Assign 2 points) or global (when the impact reaches an environmental component of collective, national or even international or global importance - Assign 3 points).
Probability	Potential environmental aspects or impacts, associated or not to risk situations, should be evaluated according to their probability of occurrence, which should be qualified and scored as follows: high (3 points), average (2 points) and low (1 point). It should be emphasized that the environmental aspects/impacts associated to risk situations should be addressed in specific risk analysis studies, so that their probability is determined by the applicable risk analysis methods.
Severity	The environmental aspects/impacts should be evaluated according to their magnitude and reversibility. It is suggested that the classification and scoring of this characteristic is as follows: high (3 points - referring to an aspect that causes or may cause high or medium magnitude or intensity impacts which are irreversible or difficult to reverse), average (2 points - referring to an aspect that causes or may cause impacts of high or medium magnitude or intensity and yet are reversible), and low (1 point - referring to an aspect that causes or may cause impacts of minimum intensity/magnitude regardless of their reversibility).
Detection	There are different levels of difficulty in the quantitative or qualitative evaluation and/or measurement of the potential and actual environmental aspects/impacts of an organization. Known as degrees or limits of detection, these limits influence how one interprets the significance of environmental aspects/impacts, which can be classified and scored as: difficult (3 points), moderate (2 points), easy (1 point).

Using these four criteria, and in accordance with FIESP (2007) [6], the evaluation of significance of environmental aspects and impacts of the organization is therefore obtained by the following Eq. 1:

Significance = Probability (Pr) x Severity (Sr) x Reach (Rc) x Detection (De) (1)

This score is necessary, but not sufficient, for the final evaluation of significance of the company's environmental impacts [6]. In this regard, Table 2 presents the values, their respective significance and some suggested actions for each type of aspect and environmental impact.

Table 2 Final significance of environmental impacts and actions to be taken [6].

Score	Significance	Suggested minimum actions
From 01 to 06 points	Not significant	Keep routine — if the respective aspect is real. Action plan — if the respective environmental aspect is potential.
From 08 to 16 points	Significant	Operational control — if the respective environmental aspect is real. Action and/or emergency plan — if the respective environmental aspect is potential.
Equal or above 18 points	Very significant	Operational control and action and/or emergency plan — if the respective environmental aspect is real. Action and/or emergency plan — if the respective environmental aspect is potential.

3. Methods

In regard to the approach, the study is a qualitative research as it is concerned with deepening the comprehension of the subject while also seeking to explain the reasons behind things and presenting what should be done. It does not, however, qualify values nor submit factual evidence [7].

As for its nature, the research is classified as applied, since it generates knowledge that is directed to the solution of specific problems and for practical application, involving local truths and interests [7]. The article can be classified as exploratory research, because, according to Gil (2010) [8], this type of research aims to better understand the problem studied, involving bibliographical survey, interviews with people who live with the problem and analyses of examples.

The elaboration of this study is based on the guidelines presented by ISO standard 14.001:2015. The general objective was to determine some of the necessary actions for the future implantation of an EMS in an animal feed manufacturer in the city of Orleans, State of Santa Catarina.

Bibliographic surveys on EMS were carried out in order to achieve this objective, by consulting books, scientific articles, theses, etc. One of the requirements in the Standard is the identification of environmental aspects and impacts, and that is why two visits were made to the manufacturer in order to identify significant environmental aspects and impacts through direct observation of the company's production processes and also through semi-structured interviews with their collaborators. The study used the technique of simple or unsystematic observation, which establishes relationships in day-to-day facts and provides the clues to solve the problems proposed by science [8].

For the survey of environmental aspects and impacts, the modified matrix elaborated by FIESP's Environmental Department (2007) was used as method. Subsequently, some actions were recommended to mitigate the main impacts generated in the company, considering the future installation of an EMS according to ISO 14001:2015.

The first visit, carried out for observation purposes in January 2018, consisted of interviews with collaborators and evaluations of the productive cycle and surroundings of the company. The second visit happened in February with the aim of capturing records and photographs which would serve as evidence of some of the aspects found.

4. Results and Discussion

The study was carried out in an animal feed manufacturer located in the city of Orleans, Santa Catarina. The company has been active in the animal nutrition market since August 2012. Currently, eight employees work in the company. The main raw materials used in the factory are: corn, soybean meal, wheat bran, rice bran and premix (a mixture of vitamins and some amino acids). At the factory, feed is produced for cattle, pigs, poultry, horses and rabbits, in an average of nine thousand bags per month. The bags are sold directly to agricultural houses and cooperatives.

The production process consists of receiving the material, storing it or sending it to the cleaning equipment. After cleaning, the raw materials are sent to the mill, where they can be mixed and bagged to other materials and sent to the shipping department for commercialization.

Considering that the study had the objective of surveying and evaluating the environmental aspects and impacts observed in the company, an initial survey of the documentation and registration of the processes and activities of the company was necessary. After the investigation, two visits were made to the company to collect information and photographic records.

The most significant environmental aspects and impacts, gathered in the company through observation and employee interviews, are presented in Table 1.

Due to the intense entry and exit of vehicles, there is strong soil compaction in the facilities of the animal feed factory, and changes in air quality due to the burning of fossil fuels. These activities can be classified as a normal situation as to the reach of the impact, but soil compaction receives a low reach score because it is a local impact. The air quality change is of medium reach, since the impact is regional. The probability of impact of the two activities is high, as it occurs every day.

Soil compaction is of low severity, since it is an impact of minimum intensity and easy reversion, but the change in air quality is of average severity, since it is of medium and reversible intensity. The detection of both impacts is low, because it is possible to measure it. For the analysis of the soil, it is necessary to collect a sample and send it for laboratory analysis and, with the results obtained, consult an agricultural technician, agronomist or environmental engineer to know if the report is within the parameters accepted in the resolutions.

According to the observation, there is a place in the factory to wash trucks. Although the fleet is small and the washes are sporadic, the collection and treatment of the liquid effluent are not carried out. This activity can be classified as an abnormal situation and the frequency of impact can be considered low, since the washes do not occur frequently. Also, its reach is low because it is a local impact with regard to soil pollution, and also average because it has a regional impact with regard to water pollution. The production of liquid effluents containing oils and greases is of average severity, since it is an impact of medium and reversible intensity. The probability of impact is average, since it occurs at least once a month. The detection of this impact is low, because it is possible to measure it, in the case of water pollution, through the collection of the effluent sample for laboratory analysis to be performed by chemists or other specialized professionals. In order to measure the impact on the soil, it is necessary to collect a sample and send it for laboratory analysis. After the result, an agricultural technician, agronomist or environmental engineer has to be consulted to know if the report is within the parameters accepted in the resolutions.

In the factory, there is a reasonable consumption of water. It was possible to note that the sector that consumes the most quantity, in descending order, is the boiler, followed by the washing of the trucks, the cleaning of the factory and finally the consumption of the employees for hygiene and ingestion. These activities can be classified as a normal situation. The reach of the impact can be considered average, since it is a regional impact. As for the probability of impact, the activities that occur every day are: i) the consumption of water in the cooling of the boiler and ii) human water consumption, considered as high probability. The water consumption is of average severity, since it is an impact of medium and reversible intensity. The detection of this impact is low, since it is possible to visualize it through the monthly consumption report coming from the city's water supplier.

The production of particulate matter occurs through the grinding of the grains for the production of animal feed, causing some particles to dissipate in the air. The production of particulate material also occurs in the boiler, through the burning of wood and subsequent formation of ash. This activity can be classified as a normal situation. Regarding the reach of the impacts, they can be considered of medium reach since the two are of regional impact. There is a probability of high impact, since both activities occur every day. The production of particulate material is considered of average severity, since it is an impact of medium and reversible intensity. The detection of this impact is low, since it is possible to measure it.

The emission of polluting gases through the chimney of the boiler was also noted, since the chimney does not have a filter for the control of these gases. The boiler also emits steam, but this does not have a significant impact since the release of this steam is quite small.

These activities can be classified as a normal situation. Regarding the reach of the impact, the emission of polluting gases can be considered of medium reach, since it is a regional impact; the emission of steam is of low reach, because it is a local impact. As for the probability of impact, the two activities occur every day, making their probability high. The two activities are of average severity, as they are medium intensity and reversible impacts. The detection of these impacts is low, since it is possible to measure them.

In order to evaluate air quality, from the aforementioned impacts, a company specialized in this type of work can be hired to present results on the production of particulate material and the emission of polluting gases. This company can then evaluate the best methods to control these impacts.

Regarding the generation of solid waste, the low number of employees leads to a smaller disposal. These solid wastes are collected by the city's own cleaning service. This activity can be classified as a normal situation. Regarding the reach of the impact, the production of solid waste is of low reach because it is a local impact (if disposed in an incorrect way). The probability of impact of the activity is high, since it occurs every day in the company; the production of solid waste is of average severity, since it is an impact of medium and reversible intensity; the detection of this impact is low, since there are few employees in the company and the production of solid waste is smaller.

As the company is small, its impacts are, for the most part, regional. The probability in most impacts is high, since they occur almost every day. Most impacts are also of average severity, since they are of medium significance and reversible. The detection of most of the impacts found is easy, since the quantitative survey must be carried out through future measurement of the impacts investigated in this article.

Since all of the investigated impacts were found through observations, interviews and documentary analysis, a quantitative survey of the aspects found shall be carried out in order to clearly suggest the actions for the mitigation of environmental impacts. That way, in the future, the company will be able to implement an appropriate environmental management system according to NBR ISO 14001:2015. It is therefore recommended:

- The emission of polluting gases can be reduced/mitigated through the implantation/maintenance of catalysts in the vehicles, as they seek to reduce the emission of polluting gases;
- With regard to the boiler, the implementation of a sleeve filter is recommended, thus reducing the emission of particulate matter and polluting gases in the environment;
- Educational material and/or lectures of conscious consumption should also be distributed/carried out with the employees of the company so that the consumption of water and solid waste decreases, raising awareness not only in the workplace but also outside it. We suggest the implementation of a Solid Waste Management Plan, which consists in the non-production, reduction, reuse, recycling, treatment of contaminated waste and final environmentally adequate disposal;
- As for the liquid effluent containing oil and grease, two recommendations are made. The first is to send the fleet of vehicles to car washes that already treat the residual effluent. In case the company prefers to keep washing the vehicles, it should assign a specific area for this activity, waterproofing the soil and channeling the effluent into an oil, grease and water separation box. In addition, the company should collect liquid and soil effluent samples for laboratory analysis by specialized professionals, making sure that current standards are being taken into account.

The identification of environmental aspects and impacts serves to initiate the first step of the Plan-Do-Check-Act cycle, since it is possible with this

study to plan (Plan step) the mitigation of environmental impacts arising from the company's activities for the future creation of an environmental policy. In order to generate greater safety, it is necessary to make a survey with greater qualitative rigidity in the future, using equipment to measure environmental impacts.

After planning all the actions mentioned above, the company must implement them (Do), beginning with the mitigation of aspects of greater significance and not forgetting to monitor (Check) every achievement obtained with the implementation of the steps in these actions and always reporting the results. Finally, the company must have the responsibility to continuously improve its environmental objectives (Act).

5. Conclusion

The identification and classification of significant environmental aspects and impacts of the company will better guide the planning of a future EMS. It will help improve the company's image in the opening of new markets, rationalize costs, minimize the risk of accidents, among other benefits.

It was observed that most of the impacts generated by the company are of local scope, with a high probability of occurrence, average severity, since they are of medium significance and reversible, and the detection of most of the impacts found is easy. In this regard, a quantitative survey should be carried out through future measurement of the investigated impacts. The identification of environmental aspects and impacts becomes essential as a first step towards the implementation of an EMS in accordance with NBR ISO 14001:2015. Therefore, it will be necessary to quantitatively survey all the environmental aspects pointed out in this study; effectiveness and possible adequacy of all the impacts generated by the company; development of an environmental management system; and the holding of lectures and mini-courses on environmental education aimed at employees in order to raise awareness and increase their interest on the importance of environmental responsibility.

The animal feed company is very concerned about environmental issues, as it realized it needs to adapt to clients' requirements, standards and the laws in force, guaranteeing these demands through the implementation of an EMS and thus introducing a new and more proactive management proposition.

Through this study, other companies in the animal feed segment may realize how important it is to take the initial step in introducing an environmental policy into their organizations and processes. The survey of the significant aspects and impacts to later reduce them when executing the company's activities is a case study which can serve as an example for other companies of the same field.

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