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# Environmental Impact: Contextualization and Current Reality

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### Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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## ABSTRACT

The environmental impacts of human acts have been a global concern of the contemporary era. The conflict between economic development and environmental protection is a very important topic to be considered before beginning any human activity that may cause negative effects to the environment. This work was designed to review the types of environmental impacts, their classes, and the Brazilian laws related to them. Additionally, this work shows the consequences of human actions on the environment around the world that without the proper assessment can lead to disasters and outcomes that may never be reversed. Although environmental impacts and sustainability are not new subjects, environmental disasters still occur with a certain regularity worldwide, pointing to the human negligence as a possible source of environmental disasters. It is important for companies, farmers, and the general public to realize how the environmental impacts their daily lives, and the required measures to minimize the negative effects.

**Keywords:** Environment; impact; pollution; assessment; disaster.

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## 1. INTRODUCTION

Since the 1960s, there has been a high global concern with the environment and the equilibrium between environmental protection and economic development [1]. Developed countries, with stable economies, tend to prioritize environmental protection, while developing countries, attempting to compete in the global market, tend to prioritize economic development [2].

Despite the concern of environmental protection, there seems to be a loss of focus which is supported by the frequency of environmental accidents around the world, which affect soil, water sources, and ultimately society [3].

In order to prevent the continuing occurrence of environmental accidents and their subsequent hazards, it is necessary to develop educational materials that can be used as a tool to raise environmental awareness of individuals and society in general about the concepts of environmental safety and the reality of environmental mishap in the 'real' world.

## 2. REVIEW

### 2.1 Environment

Brazil [4] defines the environment as the set of conditions, laws, influences, and physical, chemical, and biological interactions, which allow, harbors, and rules the life in all its forms.

However, this definition is incomplete, leaving gaps that can result in different interpretations by courtroom juries, notwithstanding the diversity of terminology related to the environment, derived from different contexts. From one perspective, the environment is considered a source from which society extracts the necessary (natural) resources for its development and survival. Another perspective, considers the environment as the source of life where ecological functions occur naturally, giving rise to the concept of environmental resources, e.g., a supply of resources or the possibility of providing functions that support life within nature/the environment [5].

This perspective is supported by [6], which does not define environment as a medium to be defended or preserved, but as a system with the

capability to provide resources, renew social forms and development [7].

Theys [8] conceptualizes the environment in two ways, the objective and the subjective. The objective conceptualization treats the environment as a union of many natural objects of different scales and organizing principles, that are considered biocentric, since the species involved are not hierarchically organized. The subjective conception treats the environment as the relationship between humans and the medium, that is, between subjects (societies, individuals) and objects (fauna, flora). Fiorillo [9] separates the environment into different classes such as artificial environments, digital environments, cultural environments, work environments and natural environments.

### 2.2 Pollution

Environmental topics took years to be part of the public debate in Brazil, leading to the creation of laws that addressed the issue of environmental protection, particularly with situations related to pollution [10]. In an uncomplicated way, pollution is understood as any form or condition that is harmful to living beings [10]. These conditions usually are the result of human activities which, in a certain way, "dirty" the environment [5].

While in Brazil, laws against pollution were passed in 1975 in Rio de Janeiro, and 1976 in São Paulo, other countries, including the United States (USA) and United Kingdom (UK), were concerned about pollution years before [11]. In 1948, the USA already had a law to control water pollution, and in 1955 a law referring to air pollution, similarly in 1956, the UK passed a law for clean air [5].

Pollutants are elements, entities, or factors can be measured and compared to standards established by legislation (laws) and regulations (guidelines for implementing laws) for chemical compounds in waters, gases emitted into the air, vibration, noises, and radiation, etc. [12]. However, such a definition is absent in the Brazilian National Environmental Policy Law, that defines pollution as causing an 'environmental impact'. Not all pollution has an impact, but most pollution causes an environmental impact. Due to the confusing nature of this term, it began to be replaced by a broader term, environmental impact [4,5].

## 2.3 Environmental Impact

Environmental impact is commonly associated with damage to nature [13]. The literature contains different ways of classifying environmental impact such as alterations caused to the environment in a simplified form or as a whole, alterations caused by human interference, or the effect of an action induced by man over the ecosystem [14,15].

According to Munn [16] it is necessary to introduce the dynamic processes that occur in the environment, so it can be established that environmental changes can be assessed as impacts. Still, according with this author, when determining the impact of an activity, it is necessary to compare two hypothetical situations, one considering how the situation without the activity would affect the environment, and the other considering the activity occurring in the environment. The difference between these two situations will show the environmental impact caused by the activity and not the difference between the two situations.

The NBR ISO 14001 [17], of 1997 defines environmental impact as any changes in the environment, adverse or beneficial, that affects, as a whole or in part, of the activities, products or services of an organization. This concept is largely used by companies and organizations for their environmental management.

Environmental impact can also be defined as any kind of alteration that the environment undergoes, whether chemically, physically or biologically, resulting from human activities that release any kind of matter or energy that may, directly or indirectly, affect the populations health, economical and/or social activities, the values of the environmental resources and the biota [18].

According to Sanchez [5] this definition is still not correctly followed when implementing an environmental impact assessment or when using the restrictive sense as in court interpretations.

### 2.3.1 Classification of environmental impact

In the context of environmental impact, it is possible to carry out a stratification and classify the other existing environmental impacts as positive, negative, direct, indirect, local, regional, strategic, immediate, medium or long term, temporary, permanent, cyclic, and reversible. It is

worth pointing out that an activity may cause more than one environmental impact during its execution [5].

#### 2.3.1.1 Positive environmental impact

A positive environmental impact is one that improves any environmental factor or parameter, as defined by the government [5]. For example, it is possible to mention the relocation of a population to a block of improved houses, waste management, recovery of riparian forest, implementation of new activities [19].

#### 2.3.1.2 Negative environmental impact

When a certain action is taken, and this results in damage that harms the quality of a parameter or an environmental agent, there is a negative environmental impact [5]. These must be discouraged by the government and, if necessary, through penalties arising from the authorities. As example of negative environmental impact there is the clandestine destination of pollutants by companies or citizens, directly into the air or water without proper treatment.

#### 2.3.1.3 Direct and indirect environmental impact

A direct environmental impact is one where there is a cause and an effect, while an indirect impact is when a secondary reaction or a chain reaction is caused by the first action [5]. The extinction of a forest decreases or extinguish the local biological diversity, causing a direct impact. The gas release by a company may cause acid rain, being it an indirect effect [20].

#### 2.3.1.4 Local, regional and strategic environmental impact

When the impact does not affect other regions, but only the place within the activity, it is considered to be as a local impact, as an example can be mentioned a mining activity. When the impact expands beyond its local surroundings, as in the building of a highway, there is a regional impact. A strategic impact is that of collective or national interest, such as the implementation of irrigation projects in the Brazilian northeast by means of the transposition of a river [20].

#### 2.3.1.5 Immediate, medium or long-term and cyclic environmental impact

An action which causes an effect to happen immediately is called an immediate

environmental impact. For example, an immediate environmental impact is experienced by fishes who die in a river due to the release of toxic compounds into it. The bioaccumulation of contaminants (like methyl mercury) in the food chain is an example of medium or long-term environmental impact, because it takes time for these effects to appear, and, when effects occur at regular time intervals, this called a cyclic environmental impact [20].

### *2.3.1.6 Temporary and permanent environmental impact*

An example of a temporary environmental impact is the leakage of petroleum (oil) onto a coastline which is gradually absorbed by the environment in time. Radiation is an example of a permanent environmental impact, and its effects can take many years to be realized [20].

### *2.3.1.7 Reversible and irreversible environmental impact*

The burning of tires causes air pollution that, with time, dissipates and the air returns to its original condition, and this is an example of a reversible impact. Erosion that results from excessive rainfall is an irreversible environmental impact, since the soil needs thousands of years to rebuild its mass and fertility [20].

## **2.4 Adopted Measurements**

When the environmental impact of a particular activity is known, Brazilian environmental legislation and associated regulations determines which compensatory or mitigation measures are to be enacted. Compensatory measures are applied when there is a negative impact, and there is the requirement for some action to occur to compensate for the damage caused. Mitigation measures minimize a negative impact, such as the use of ecologically safe products in construction [5].

## **2.5 Environmental Impact Assessment (EIA)**

The emergence of the Environmental Impact Assessment (EIA) as a mechanism for environmental management in the last 40 years coincides with the recognition of the nature, scale, and implications that environmental changes have brought for human actions [21].

The (USA) National Environmental Policy Act (NEPA) was the first one that represented a formal incorporation of the analysis process on environmental impacts in legislative form [22]. The law established a national policy which would guide federal agency activities, communities, and protect the natural environment in a significant way [23].

Internationally, the institutionalization of EIA has progressed slowly over the past few decades, but has received increased emphasis through the growing political recognition of the problems associated with climate change, biodiversity loss, threats to hydrological resources and water quality, and damage to marine areas [21].

Various interpretations exist about the EIA as an activity that identifies, predicts, clarifies and transmits information about any activity that may harm the public welfare, as an instrument of environmental policy. The EIA is composed of a group of procedures that are capable of ensuring that a systematic exam of the possible environmental impacts of an activity and its alternatives is undertaken. The EIA results should be displayed in a proper way to the lay population and for those responsible for making the decisions on activities with environmental impact [16,14,24].

The Environmental Impact Assessment must be implemented for any activity that may or will cause future damage to the environment, and must be accomplished before the activity can start. Based on this approach, the EIA is performed for mining activities, pipelines, hydroelectric projects, highways, industries, slurry treatment stations, and sanitary landfills [18].

This instrument (EIA) has been used in Brazil since 1986, along with the Environmental Impact Report, which is covered in Brazil's national environmental legislation [18,25].

### **2.5.1 Environmental impacts classifications**

Since the EIA was developed in the 1970s, a number of different analyses and associated forms have been developed to make this process more comprehensive, including the Social Impact Assessment (SIA), Health Impact Assessment (HIA), and the Strategic Environmental Assessment (SEA). To a certain extent, each of the other processes was developed because of some level of dissatisfaction with the EIA and in how it has been implemented [21].

## 2.6 Brazilian Legislation

Brazil has one of the most complete and advanced sets of environmental legislation in the world [26]. The idea of protecting areas and natural ecosystems in the Brazilian environment dates back to 1934, when the Brazilian Forestry Code was created, and since then, many codes, resolutions, laws, and decrees appeared with the intention of assuring the protection of the national ecosystems. However, the legislation is not adequately applied due to the lack of resources and lack of technical capacity to enforce it [27].

The environmental crimes law, or Nature Law (law n° 9.605, February 12 1998), deals with violations and punishments, in addition to defining and classifying environmental crimes into six types: **a)** crimes against the Fauna; aggressions committed against wild animals, whether native or migratory; **b)** crimes against the Flora: destroying or damaging permanent preservation forests, even if they are newly formed, or if being used improperly; **c)** pollution: pollution which causes, or may cause, damage to human health, the death of animals and plants; **d)** crimes against urban planning and cultural heritage: construction in preservation areas or its surroundings, without authorization, or in discordance with authorization; **e)** crimes against environmental administration: false or misleading statements, omission of information and technical-scientific data in environmental licensing or authorization processes, and further administrative infractions; **f)** actions or omissions that violate legal rules of use, enjoyment, promotion, protection, and recovery of the environment. The individual or legal entity that infringes the law, if proven guilty, whether initiator or conspirator, can be penalized with fines ranging from 50 Brazilian reals to 50 million Brazilian reals. This punishment also can be reversed if the initiator works to recover the environmental damage [28].

## 3. COMPANIES AND THEIR MEASURES FOR REDUCTION OF NEGATIVE ENVIRONMENTAL IMPACTS

### 3.1 Svenska Kullager Fabriken

Svenska Kullager Fabriken, or SKF is a company of global importance in the supply of products and services for fences, bearings, lubrication systems, hand tools and machine tools, and mechatronics [29]. The company planned, in

2016, to implement a program that they called the 'Beyond Zero' strategy, which was designed to increase positive environmental impacts by going beyond the simple idea of operational reduction of environmental impacts. Besides reducing carbon emissions, energy spending, and reduction of production related costs, the strategy aimed to bring innovation to the production system in order to diminish or prevent negative environmental impacts. Among the strategies used by the company was an aggressive management system to reduce energy expense in all 140 of its industrial locations around the world, use of different kinds of transportation to reduce carbon emissions, and the adoption of enhanced logistics planning for the transportation and distribution of its products [30].

### 3.2 Coca-Cola Enterprises

With respect to the reduction of negative environmental impacts, the Coca-Cola Corporation plans to have a low-cost carbon emission reduction effort in its production process aligned to a 'zero waste' philosophy, which focuses on innovation, packaging, and recycling [31]. The company already guarantees that 99,5% of its wastes is already recyclable, however, its goal is to recycle even more resources than the ones used in its production of more than 12 billion bottles annually [30].

## 4. ENVIRONMENTAL DISASTERS

An environmental impact can be considered as an environmental disaster when the damage caused is irreparable or incalculable [32]. The following sections illustrate some of the main environmental disasters occurring in the past decade.

### 4.1 Hungary, 2010

In October 2010, in Ajka, one of the most serious environmental accidents in Hungary occurred [33]. In an aluminum factory, the containment dams were broken, and approximately one million cubic meters of toxic solid waste was released into the streets of Ajka. The "red sea" of waste reached up to two meters high in some parts of the city. As a result, four deaths were confirmed, 123 were injured, and more than 400 inhabitants of the region had to be relocated, who displayed a reaction to the toxic substance [34,35].

## 4.2 United States, 2010

In April 2010, an explosion at the Deepwater Horizon oil rig generated the largest oil spill in the history of the United States [36]. This accident caused 11 deaths, 17 were injured, and about 3.9 million barrels of petroleum (oil) polluted the water for 87 days until British Petroleum (BP) could stop the leak. An enormous black mark was formed on the American Gulf Coast due to the oil leak. This disaster caused environmental consequences with the decimation of the local fisheries, and the political and economic consequences, mainly in the tourism and water-related activities in the region, since the beaches were closed for several months [34,37].

## 4.3 Brazil, 2015

In November 2015, in the interior of Minas Gerais, a dam that contained contaminated mud from the mining process of the Samarco corporation failed. This caused the release of approximately 62 million cubic meters of waste, which flowed toward the city of Mariana and other neighboring cities. This tragedy caused 18 deaths, excluding the contamination of the Rio Doce basin, which is responsible for supplying more than 230 municipalities in Minas Gerais and in the state of Espírito Santo. The Brazilian Institute of Environment and Renewable Natural Resources (“IBAMA – Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis”), evaluated the ecological impact and determined that more than 80 species in the river were in risk, 12 of which were specific to this habitat, and these may have become extinct due to the dam breach. Many believe that the river will never return to its natural state [37,38].

## 5. CONCLUSION

From the literature, it is possible to conclude that the ‘environment’ is a broad concept, which encompasses much more than the natural environment or the physical environment. Brazilian environmental legislation points to the use of various techniques and methods for evaluating the environmental impact of a particular enterprise or activity, and directs that an installation or activity is effective in eliminating or reducing negative environmental impacts. Even so, there is a deficiency in the public’s compliance with Brazilian environmental laws. There is also a need to for greater understanding of Brazilian environmental policies and the

duties of the general public regarding the environment.

## COMPETING INTERESTS

Authors have declared that no competing interests exist. The company name used for this research is commonly and predominantly selected in our area of research and country. There is absolutely no conflict of interest between the authors and company because we do not intend to use this company as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the company rather it was funded by personal efforts of the authors.

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