

Article

Environmental Management of Ecuador's Business Sector in the Fight against Climate Change

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Abstract: The private sector is part of the United Nations Global Compact, which promotes the voluntary participation of organizations to implement environmental care strategies. The purpose of this article is to examine the performance of Ecuadorian companies in regard to environmental management, especially in the fight against climate change, considering the economic sectors (manufacturing, mining, commerce, construction and services). Figures from the National Institute of Statistics and the Census of Ecuador (2020) are used, including descriptive statistics and cross-tabulations with Cramer's V index. The results show that approximately 5% of companies had the ISO 14001:2015 certification. In the seven actions against climate change considered, the proportion of companies that did not consider them to be current expenses predominated. Cramer's V index, for associating the economic sector and the environmental spend, revealed that certain economic sectors (manufacturing and mining) are contributing significantly to environmental management spending in the areas of air, soil, wastewater and waste treatment, while no economic sector dominates the others in areas such as radiation treatment, the use of mineral or energy resources and water resources.

Keywords: companies; economic sectors; combating climate change; environmental expenditure



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1. Introduction

Companies worldwide must contribute to socio-economic development, beyond what they contribute by creating jobs and paying taxes, this implies so-called corporate social responsibility, which involves company practices that seek to avoid harm, while promoting the welfare of stakeholders by abiding by existing regulations and standards, and voluntarily going beyond what is required [1]. This responsibility encompasses not only their internal and external customers, but the community in general and the environment. In regard to this last aspect, today more than ever, they are committed to joining the fight against climate change.

In this sense, the United Nations Global Compact “is a non-binding agreement that seeks to promote sustainable development and compliance with human rights and labour standards, as well as to fight corruption, in business activities worldwide”. It was established in 2000, with the aim of creating a common framework for developing corporate sustainability practices, and two decades after its creation, 10,000 companies have signed up to it [2].

This pact is based on 10 principles that have human rights, labor standards, the environment and anti-corruption as fundamental pillars, establishing that signatory companies commit to implement and report annually about progress in these areas, indicating the actions and policies implemented [3]. Among the principles, those that are directly linked to environmental care and that are aligned with the business commitment to fight climate change are Principle 7 “Businesses should maintain a precautionary approach to environmental challenges”, Principle 8 “Businesses should encourage initiatives that promote greater environmental responsibility”, and Principle 9 “Businesses should encourage the development and diffusion of environmentally friendly technologies” [4].

In addition to this, globally there is the ISO 14001:2015 standard [5]. “This International Standard specifies requirements for an environmental management system that an organization can use to improve its environmental performance” and can be implemented by any organization wishing to manage its environmental responsibilities towards sustainability [5].

In Ecuador, within the framework of the Global Compact and with the support of Ørsted and Natura & Co and sponsored by En+ Group, there is a program called the Climate Ambition Accelerator, which aims to “scale up credible climate action in companies of all sizes, sectors and regions, enabling them to meet meaningful commitments to reduce emissions at scale”. This program equips companies with the knowledge and skills needed to accelerate progress towards setting science-based emissions targets aligned with the 1.5 °C pathway, whose participation requires that they are committed to a local Global Compact network in their region or willing to join, that they are committed to the Paris Agreement and that they are willing to appoint two representatives to participate in the program’s activities and events and a representative person at a senior level to follow program developments, provide support and participate in high-level events [6].

The latest results from the Global Compact Ecuador 2020 show that 34 recognized companies in the country participated in the Climate Ambition Accelerator program [7]. In addition, there is the Ecuador Verde program, whose purpose is to provide training on the reduction of carbon emissions.

Climate change is a consequence of an infinite number of factors, which are not only related to direct air pollution, but also to the use and treatment of soil, waste, wastewater, energy and radioactivity, among others. Wastewater treatment generates greenhouse gases, inadequate solid waste management also has an impact, as organic waste in landfills produces methane, a potent greenhouse gas. On the soil side, deforestation and unsustainable agricultural practices can result in the release of large amounts of carbon stored in the soil.

Fossil fuels, such as coal, oil and gas, “are the major causes of global climate change, as they are responsible for more than 75% of total global greenhouse gas emissions and about 90% of all carbon dioxide emissions” [8]. Also, the handling of radioactive waste can contribute to climate change if greenhouse gases (GHGs) are emitted during the treatment, transportation, storage or waste disposal process. Hence, the importance of the transition to renewable energies, produced by the sun, wind, water, waste or the Earth’s own heat, which are renewed by nature itself and emit few (or none) pollutants or greenhouse gases into the air.

In this sense, it is important to analyze corporate environmental management in order to visualize the efforts made by private companies to promote environmentally sustainable development. This is the case in the research by Ochoa and other authors, which considers “estimates of current expenditure and investment in environmental management of the private sector versus GDP during the period 2010–2015 in Ecuador, supported by the finding of the environmental Kuznets curve (CKA)”. The study uses linear regression to visualize the relationship between economic growth (GDP) and environmental degradation (CO₂ emissions), incorporating the current expenditure and environmental investment related to the variables made by private companies.

The main conclusion in this study is that “based on estimates, spending on environmental management is at 0.34% of GDP on average during the study period and environmental performance is in an increasing phase of the Kuznets curve”, i.e., the higher the country’s economic growth, the greater the environmental deterioration. It is ratified that Ecuador, “being a developing country, has not yet reached the inflection point of this curve, this being possible when it reaches a level of per capita income that transforms environmental degradation into a decreasing trend”. In this study, indicators obtained from the Central Bank of Ecuador, such as GDP, and from the INEC, related to the survey of economic environmental information in private companies, were used [9].

Also, it is relevant to mention the analysis by Duarte, who categorizes the possible postures of companies facing the environmental problem, through an adaptation of Robbins and Coulter in 2010. Duarte, points out four postures [10]:

1. The reactive posture. Companies that face environmental problems only when they arrive, indicating zero sensitivity to environmental issues.
2. The accommodating posture. Companies that make decisions to comply with legal regulations related to environmental issues.
3. The stakeholder posture. Companies that focus on satisfying the environmental demands of internal and external stakeholders.
4. The proactive stance. Companies that anticipate or plan for environmental problems that could occur in their internal and external environment, through the implementation of actions to prevent their occurrence.

In addition, Duarte presents a general scheme of environmental innovations in private enterprise, as shown in Figure 1.

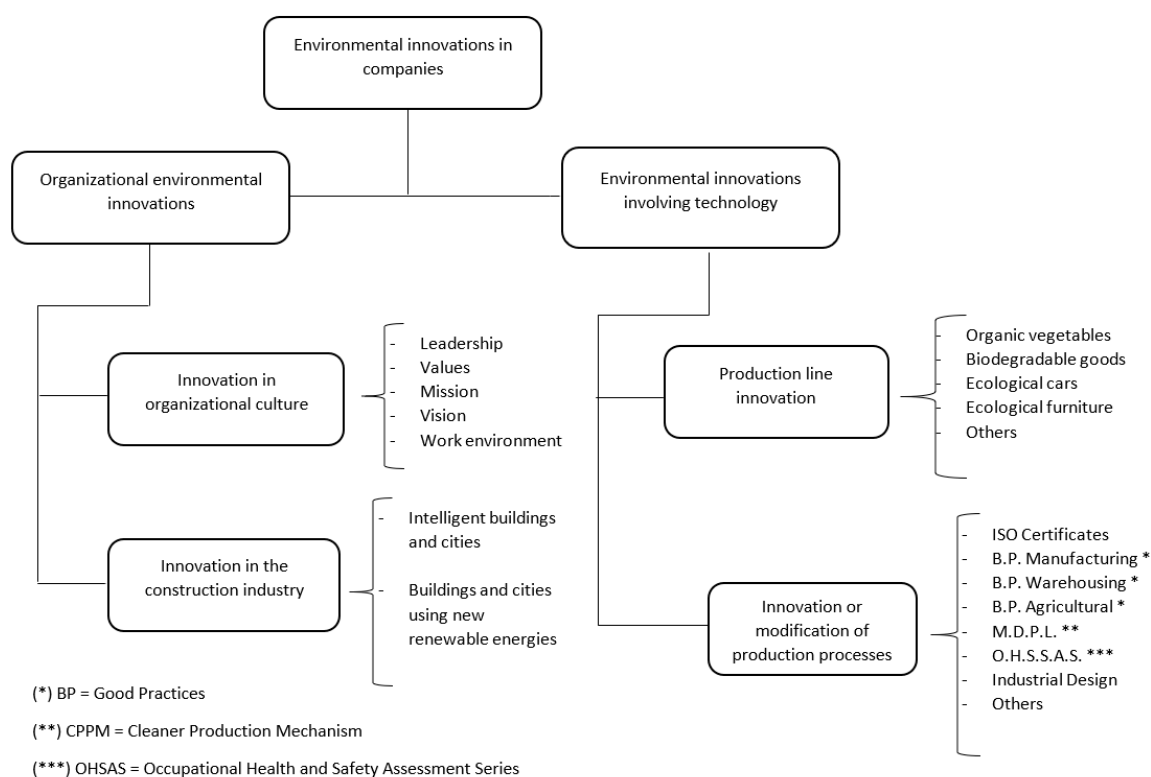


Figure 1. General outline of environmental innovations [10].

On the other hand, the analysis of corporate social responsibility (CSR) conducted by [11] aimed to determine the measures for sustainable environmental management in the face of the effects caused by productive processes.

This study “identifies and analyzes the implementation of corporate social responsibility towards environmental practices in Ecuadorian companies during the period 2017 to 2020, through the systematization of information from 13 articles from journals indexed in databases”. In this sense, it extracts articles from Scopus, ScienceDirect, Doaj, Dialnet and Google Scholar, in the context of: knowledge and compliance with corporate social responsibility, dimensions of corporate social responsibility towards environmental management, and good environmental practices. “The main results show that there is a lack of knowledge about the application of corporate social responsibility, and companies tend to implement strategies that favor economic and social practices leaving aside environmental practices” [11].

Identifying which sector affects climate change the most can be complicated, as they all contribute in different ways to greenhouse gas (GHG) emissions, and the magnitude of each sector's impact may vary by region and specific practices within each sector; however, some general observations can be made. The manufacturing sector, due to its manufacturing processes, uses chemicals and a lot of energy, generally generated from fossil fuels. The mining sector involves deforestation, soil disturbance and the release of methane during the extraction of coal. This sector also consumes large amounts of energy. The construction sector involves the production of materials, such as cement and steel, as well as the generation of construction and demolition waste. The commerce sector has an impact, especially through the long-distance transportation of goods, and the services sector, although smaller, has an impact mainly through energy consumption by commercial buildings, transportation and public services.

In this research, the main objective is to analyze the performance of each of the five business sectors established in Ecuador, namely manufacturing, commerce, mining, construction and services, to determine their contribution in regard to environmental management actions, especially those that impact the fight against climate change. Hence the research question is: What is the contribution of Ecuador's business sectors in the fight against climate change, considering actions in specific areas, such as the current expenditure?

2. Methodology

In Ecuador, the National Institute of Statistics and Census (INEC) conducts surveys of companies in the national territory to determine progress in setting science-based emissions targets, in order to assess an organization's transition to net zero. The results of these surveys are recorded in the Environmental Economic Information Module for Companies [12].

This study is a documentary, descriptive study, whose main source is the Environmental Economic Information Survey of Companies (EIAEE) [12] conducted by the INEC in 2020, involving a total of 3777 companies throughout the country, whose purpose is to generate statistics on the expenditure and investment made by companies to prevent, reduce or eliminate pollution resulting from the development of their activities (emissions of air pollutants, noise pollution, treatment of wastewater and solid waste generated, etc.), defined by the United Nations' Classification of Environmental Protection Activities.

In this case, the classification by sector is considered, which has five categories, namely manufacturing, commerce, mining, construction and services, examining, using the EIAEE, the environmental expenditure in general and the expenditure for each of the actions linked to the fight against climate change, considered as the current expenditure of the company. To analyze these variables, descriptive statistics are considered, with the main measures being the mean, maximum, minimum and percentiles. These statistics are calculated both for the total environmental management expenditure and for each of the seven variables related to the reduction, prevention and minimization factors focused on the fight against climate change.

In addition, the classifications by economic sector of the companies are crossed with the type of action linked to the fight against climate change, which the company has considered as its current expenditure; since, in the private sector, current expenditure is the set of expenses that are considered essential for the company's ordinary activities and, therefore, are not superfluous [13]. The variables are analyzed using quantitative and qualitative measurements (Table 1).

Table 1. Study variables.

Variable	Quantitative Measurement	Qualitative Measurement
ISO 14001:2015	-	Obtaining certification YES/NO
Total expenditure on environmental management	Total amount and by economic sector	-
Reduction of emissions or pollutant concentrations in the air	Total amount	Inclusion as current expense by economic sector YES/NO
Prevention of surface water pollution	Total amount	Inclusion as current expense by economic sector YES/NO
Prevention of waste generation	Total amount	Inclusion as current expense by economic sector YES/NO
Prevention of infiltration of soil and groundwater pollutants	Total amount	Inclusion as current expense by economic sector YES/NO
Reduction or elimination of the negative consequences of radiation emitted by any source	Total amount	Inclusion as current expense by economic sector YES/NO
Minimization of the use of mineral and energy resources	Total amount	Inclusion as current expense by economic sector YES/NO
Minimization of water resource extraction	Total amount	Inclusion as current expense by economic sector YES/NO

Qualitative and quantitative variables.

Using cross-tables with Cramer's V index, the hypotheses are established to determine the association between the variables mentioned. Cramer's V test is an index that measures the relationship between two categorical variables. It is based on the chi-square coefficient, but is corrected to obtain a value between 0 and 1. A value of 0 indicates that there is no association between the variables, and a value of 1 indicates a perfect association. A weak association is considered to exist if the value is between 0 and 0.2, a moderate association if it is between 0.2 and 0.6, and a strong association if it is between 0.6 and 1.0 [14].

Cramer's V index is calculated from the chi-square statistic and the total number of observations in the contingency table. The formula is (1):

$$Cramer's\ V = \sqrt{\frac{x^2}{n \cdot \min(r - 1, c - 1)}} \quad (1)$$

where:

- x^2 is the value of the chi-square statistic;
- n is the total number of observations in the table;
- c is the number of columns in the table;
- r is the number of rows in the table.

The expression " $\min(r - 1, c - 1)$ " means that the number of rows and columns is reduced by 1 and the smaller of the two values is used in the equation. The Statistical Package for the Social Sciences (SPSS) program is used for data processing [15]. In this case, Cramer's V coefficient is a measure of the strength of association between two categorical variables in a contingency table, the structure of which is, on the one hand, the rows made up of the five economic sectors and, on the other, the columns formed by the YES/NO responses to each of the seven actions represented in the survey items. For data processing, the Statistical Package for the Social Sciences (SPSS), Version 25, program is used, which allows, through the analyze menu, the calculation of descriptive statistics, including frequencies for measures of the central tendency, position and dispersion, and also in crosstabs, Cramer's V index.

3. Results

The distribution of the surveyed companies by economic sector shows that the sector with the highest proportion is commerce, while the lowest is the mining sector. Of the total 3777 companies, only 199 have the ISO 14001:2015 certification, which represents only a little more than 5%. The companies belonging to the manufacturing and mining

sectors have the highest proportion of certifications, with 11.38 and 23.08%, respectively. Although, in absolute numbers, it is the manufacturing and services sectors that have the most companies with this certification (Table 2).

Table 2. Distribution of companies by economic sector and their proportion with respect to ISO 14001:2015 certification.

		Was the Company ISO 14001:2015 Certified?—Yes/No		Total
		Yes	No	
Economic Sector Code covering the main economic activity of the company 2020	Manufacturing	80	623	703
	Mining	24	80	104
	Trade	28	1634	1662
	Construction	16	165	181
	Services	51	1076	1127
Total		199	3578	3777

As for the main statistics on environmental spending reported by the companies, it can be clearly seen that, of the companies surveyed, the average is a little over USD 40,000. When examining the percentiles, it is observed that 25% of the companies do not spend anything on the environment, 50% spend below USD 1200 and 75% spend below USD 15,600. The amazing thing is that the maximum value is a little over USD 16,000,000, which implies that there is a large gap in the annual spending of more than a thousand times, between the 25% of companies that expressed the highest volume of expenditure and the other 75% of companies that spend the least on the environment.

The action to prevent the generation of waste or residues stands out in terms of the largest volume of companies participating in such activities with more than 14,000, with the maximum expenditure of almost USD 4,000,000 and the maximum total exceeding USD 28,000,000. In relation to minimizing the use of mineral and energy resources, the highest average expenditure stands out at a little more than USD 165,000, and in regard to the highest expenditure figures, considering the 25th, 50th and 75th percentiles, the latter percentile reaches an amount of more than USD 94,000.

These statistics provide key information on environmental spending, from the average amount invested to the variability and distribution of that investment. These figures help researchers, policymakers and stakeholders better understand how resources are being allocated to address environmental issues and identify areas where adjustments or different approaches may be needed.

When looking at environmental spending overall, the mining sector has the highest environmental spending, averaging USD 382,636 (Figure 2). This makes perfect sense, as the impact of mining on the environment is significant and worrisome. Large-scale mining causes irreparable physical, biological and socio-economic damage, including water and air pollution, deforestation, loss of biodiversity and land degradation [16].

Of the total environmental expenditure, considering each of the provinces of Ecuador, as shown in the illustration, it can be seen that the province in which the companies reported the highest amount is the province of Zamora Chinchipe, with an average of USD 918,283, which represents a very marked contrast with the other provinces in the country (Figure 3). In Ecuador, the province with the highest mining activity is Zamora Chinchipe, where the mines Fruta del Norte and Mirador are located, both involved in the mining production phase [17].

Simple bars average of what was the cost and expenditure in 2020 on environmental protection and management? environmental expenditure by code economic sector covering the company's main economic activity 2020

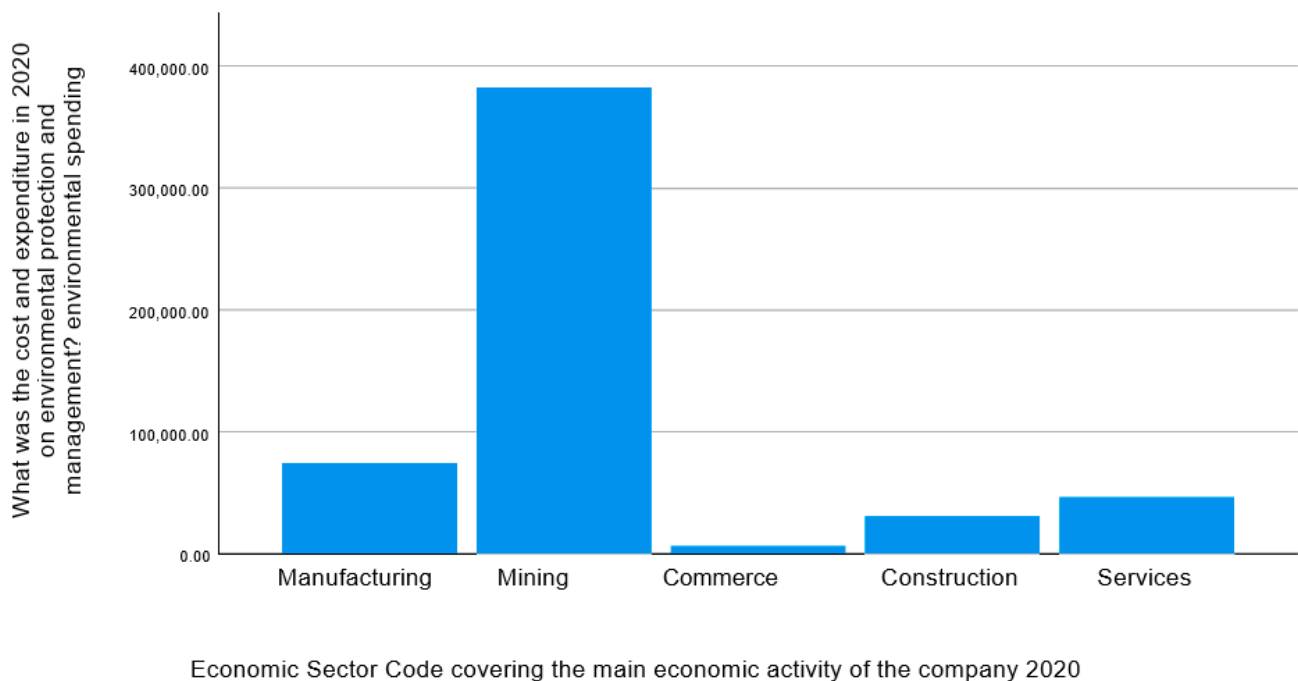


Figure 2. Average environmental expenditure by economic sector.

Simple bars average of what was the cost and expenditure in 2020 on environmental protection and management? environmental expenditure by province company headquarters 2020

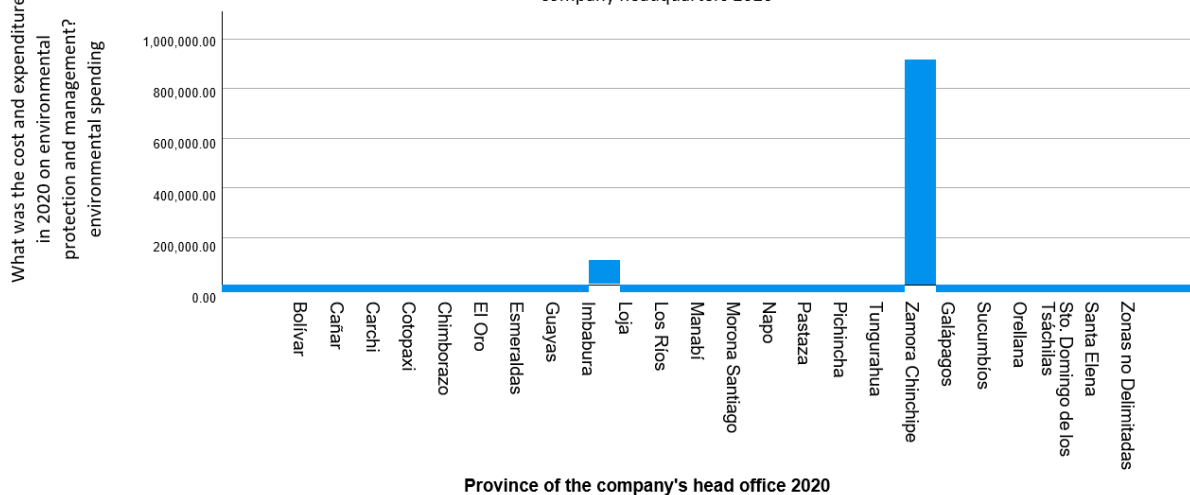


Figure 3. Average environmental expenditure by province.

With respect to the bivariate analysis, to determine associations between the variables, the following hypotheses are established:

H0: The economic sector of the company is not associated with the type of action against climate change (considered as the current expenditure).

H1: The economic sector of the company is associated with the type of action against climate change (considered as the current expenditure).

In this case, the five economic sectors (manufacturing, mining, commerce, construction and services) and seven types of actions against climate change that the companies consider to be the current expenditure are:

1. Reducing emissions or pollutant concentrations in the air (through process modification, gas treatment, measurement, laboratory control, similar activities and others);
2. Preventing surface water pollution by reducing wastewater release (includes wastewater collection and treatment);
3. Preventing the generation of waste and/or residues, the reduction of harmful effects to the environment (includes collection, treatment, recycling and composting, street cleaning and garbage collection);
4. Preventing the infiltration of soil and groundwater pollutants, the cleaning of soils and water bodies and the protection of soil against erosion;
5. Reducing or eliminating the negative consequences of radiation emitted from any source (including the handling, transport and treatment of radioactive waste);
6. Minimizing the use of mineral and energy resources by modifying processes, such as the recovery, reuse, recycling and saving of mineral sources;
7. Minimizing the extraction of water resources through the modification of processes, such as the reuse, recycling, saving and use of fresh water.

Table 3 shows the crossing of the variables analyzed and Cramer's V coefficient.

Table 3. Economic sector/reduction of emissions or air pollutant concentrations.

Reduce Emissions or Pollutant Concentrations in the Air (Through Process Modification, Gas Treatment, Measurement, Control, Laboratory, etc.)				Total
Current Costs: YES/NO		Yes	No	
Economic Sector Code covering the main economic activity of the company 2020	Manufacturing	237	466	703
	Mining	42	62	104
	Commerce	32	1630	1662
	Construction	20	161	181
	Services	81	1046	1127
Total		412	3365	3777
Symmetrical Measurements				
			Value	Approximate significance
Nominal by Nominal	Phi		0.406	0.000
	Cramer's V		0.406	0.000
N of valid cases			3777	

The highest proportion of companies that reduce emissions into the air through process modification, gas treatment, measurement, laboratory control, similar activities and others, which include this as a current expense, are those in manufacturing and mining sectors with 34% and 40%, respectively.

When examining Cramer's V index, which is 0.406, it can be pointed out that there is a moderate association between the variables. Therefore, the null hypothesis is rejected, meaning that there is an association between the economic sector of the company and the reduction of emissions into the air considered as a current expense, which is observed in the proportion of manufacturing and mining companies; these are the two sectors that are most associated with this action.

The majority of companies that prevent surface water pollution by reducing wastewater release, which include this as a current expense, are manufacturing and mining sectors with 72% and 74%, respectively (in Table 4).

Table 4. Economic sector / Prevention of surface water contamination.

Prevent Surface Water Pollution by Reducing Wastewater Release (Includes Wastewater Collection and Treatment)				Total
Current Costs: YES/NO		Yes	No	
Code of the Economic Sector that covers the main economic activity of the company 2020	Manufacturing	373	330	703
	Mining	60	44	104
	Commerce	95	1567	1662
	Construction	17	164	181
	Services	133	994	1127
Total		678	3099	3777
Symmetrical Measurements				
			Value	Approximate significance
Nominal by Nominal	Phi		0.490	<0.001
	Cramer’s V		0.490	<0.001
N of valid cases			3777	

When examining Cramer's V index, which is 0.490, it can be noted that there is a moderate association between the variables. Therefore, the null hypothesis is rejected, meaning that there is an association between the economic sector of the company and the prevention of surface water pollution by reducing the release of wastewater, included as a current expense, which is visualized in the proportion of manufacturing and mining companies; these are the two sectors that are most associated with this action.

The highest volume of companies that prevent the generation of waste and/or residues, the reduction of harmful effects to the environment, which include this as a current expense, are those in manufacturing and mining sectors with 53% and 58%, respectively (Table 5).

Table 5. Economic sector/prevention of waste generation and/or wastes.

Preventing the Generation of Waste and/or Residues, Reducing the Harmful Effects on the Environment (Includes Collection, Treatment, Recycling and Composting, Street Cleaning and Garbage Collection) Current Costs: YES/NO				Total
		Yes	No	
Economic Sector Code covering the main economic activity of the company 2020	Manufacturing	503	200	703
	Mining	77	27	104
	Commerce	387	1275	1662
	Construction	76	105	181
	Services	375	752	1127
Total		1418	2359	3777
Symmetrical Measurements				
			Value	Approximate significance
Nominal by Nominal	Phi		0.385	0.000
	Cramer’s V		0.385	0.000
N of valid cases			3777	

When examining Cramer's V index, which is 0.385, it can be pointed out that there is a moderate association between the variables. Therefore, the null hypothesis is rejected, which means that there is an association between the economic sector of the company and the prevention of waste generation, considered as a current expenditure, which is seen in the proportion of manufacturing and mining companies; these are the two sectors that are most associated with this action.

The largest number of companies that prevent the infiltration of soil and groundwater pollutants, cleaning of soils and water bodies and soil protection against erosion, which include this as a current expense, are in the mining sector with 28% (Table 6).

Table 6. Economic sector/prevention of infiltration of soil and groundwater contaminants.

Preventing Infiltration of Soil and Groundwater Pollutants, Cleaning of Soils and Water Bodies and Protection of Soil against Erosion				Total
Current Costs: YES/NO				
		Yes	No	
Code of the Economic Sector that covers the main economic activity of the company 2020	Manufacturing	54	649	703
	Mining	29	75	104
	Commerce	18	1644	1662
	Construction	12	169	181
	Services	23	1104	1127
Total		136	3641	3777
Symmetrical Measurements				
Value				Approximate significance
Nominal by Nominal		Phi	0.259	0.000
		Cramer’s V	0.259	0.000
N of valid cases			3777	

When examining the Cramer's V index, which is 0.259, it can be noted that there is a moderate association between the variables. Therefore, the null hypothesis is rejected, which means that there is an association between the economic sector of the company and the prevention of infiltration of soil and groundwater contaminants, the cleaning of soils and bodies of water and the protection of soil against erosion, included as a current expense, which is observed in the proportion of mining companies; this is the sector that is most associated with this action.

The largest fraction of companies that reduce or eliminate the negative consequences of radiation emitted from any source, which include this as a current expense, are from the mining sector with 1.9% (Table 7).

When examining the Cramer's V index, which is 0.053, it can be noted that there is no association between the variables. Therefore, the null hypothesis is accepted, meaning that there is no association between the economic sector of the company and the reduction or elimination of the negative consequences of radiation, considered as a current expense; this can be seen in the proportion of companies in all sectors, since in general, they oscillate in very even percentages, which do not exceed 2 percent.

The largest portion of companies that minimize the use of mineral and energy resources by modifying processes, such as the recovery, reuse, recycling and saving of mineral sources, which include this as a current expense, come from the manufacturing sector with 2.6% (Table 8).

Table 7. Economic sector/reduction or elimination of the adverse effects of radiation.

To Reduce or Eliminate the Negative Consequences of Radiation Emitted from Any Source (Including the Handling, Transportation and Treatment of Radioactive Waste)				Total
Current Costs: YES/NO				
		Yes	No	
Code of the Economic Sector that covers the main economic activity of the company 2020	Manufacturing	4	699	703
	Mining	2	102	104
	Commerce	2	1660	1662
	Construction	1	180	181
	Services	7	1120	1127
Total		16	3761	3777
Symmetrical Measurements				
Value				Approximate significance
Nominal by Nominal	Phi	0.053	0.031	
	Cramer’s V	0.053	0.031	
N of valid cases			3777	

Table 8. Economic sector and minimization of the use of mineral and energy resources.

Minimize the Use of Mineral and Energy Resources by Modifying Processes, such as the Recovery, Reuse, Recycling and Saving of Mineral Sources				Total
Current Costs: YES/NO				
		Yes	No	
Code of the Economic Sector that covers the main economic activity of the company 2020	Manufacturing	18	685	703
	Mining	1	103	104
	Commerce	4	1685	1662
	Construction	0	181	181
	Services	12	1115	1127
Total		35	3742	3733
Symmetrical Measurements				
Value				Approximate significance
Nominal by Nominal	Phi	0.090	0.000	
	Cramer’s V	0.090	0.000	
N of valid cases			3777	

When examining the Cramer's V index, which is 0.090, it can be pointed out that there is no association between the variables. Therefore, the null hypothesis is accepted, meaning that there is no association between the economic sector of the company and the minimization of the use of mineral and energy resources, included as a current expense. This can be seen in the proportion of companies in all sectors, since in general, they oscillate in very similar percentages that do not exceed 3 percent.

The largest number of companies that minimize the extraction of water resources by modifying processes, such as the reuse, recycling, saving and use of fresh water, which include this as a current expense, are from the mining sector with 9.6% (Table 9).

Table 9. Economic sector/minimization of water resource extraction.

Minimize the Extraction of Water Resources by Modifying Processes, such as the Reuse, Recycling, Saving and Use of Fresh Water. Current Costs: YES/NO				Total
		Yes	No	
Code of the Economic Sector that covers the main economic activity of the company 2020	Manufacturing	16	687	703
	Mining	10	94	104
	Commerce	1	1661	1662
	Construction	0	181	181
	Services	7	1120	1127
Total		34	3747	3777
Symmetrical Measurements				
Value				Approximate significance
Nominal by Nominal	Phi	0.178		0.001
	Cramer's V	0.178		0.001
N of valid cases		3777		

When examining the Cramer's V index, which is 0.178, it can be noted that there is no association between the variables. Therefore, the null hypothesis is accepted, meaning that there is no association between the economic sector of the company and the minimization of water resource extraction, considered as a current expense, which is seen in the proportion of companies in all sectors; since in general, they oscillate in very equivalent percentages that do not exceed 10 percent.

General Consideration

It can be summarized that there is a moderate association between the economic sector and the following types of action against climate change, namely the reduction of emissions or pollutant concentrations in the air, prevention of surface water pollution, prevention of the generation of waste and/or residues, and the prevention of infiltration of soil and groundwater pollutants, which implies that knowing the economic sector helps to predict whether a company considers these actions in its current expenditure.

On the other hand, there is no association between the economic sector and the following types of action against climate change, namely the reduction or elimination of the negative consequences of radiation emitted from any source, the minimization of the use of mineral or energy resources, and the minimization of the extraction of water resources, which means that knowing the economic sector does not help predict whether a company considers these actions in its current expenditure.

4. Discussion

The results of the EIAEE reveal that in terms of ISO 14001:2015 certifications, the number of companies that have this certification is very small; of the companies surveyed, only 199 out of 3777 had this environmental management certification, which only represents a little more than 5%. Although, worldwide it is noted that "emissions are increasing, but fortunately, so are the number of certifications globally not only in ISO 14001:2015 but also in other standards such as ISO 9001, ISO 45001 or ISO 27001" [18].

The fact that companies are ISO 14001 certified is relevant because they are standardized norms, which allow them to apply the same principles and practices to improve their environmental performance. It also helps them to identify, control and continuously

improve their environmental impact, prevent costly environmental incidents, regulatory fines and damage to the company's reputation, as well as promoting operational efficiency.

On average, companies make environmental expenditure of a little more than USD 40,000, and it is observed that three quarters of these companies spend below USD 15,000. Hence, it is importance, not only that companies increase this expenditure, but also that more companies are incorporated into caring for the environment, which involves making the necessary disbursements. According to the United Nations, to mitigate the climate crisis and other environmental damage, it is necessary to triple the resources currently devoted to it by 2030 and quadruple them by 2050. A new report has been revealed, "which calls on the 20 largest economies in the world to promote private capital investment in this area" [19].

It is also very important that environmental spending is considered as a current expense, since it represents regular and recurring expenditure to maintain a company's operational activities.

Companies' environmental spending has a significant impact on the fight against climate change, which is also reflected in corporate sustainability, since investment in technologies and practices that reduce greenhouse gas emissions, in clean energy and technologies, in the implementation of water management systems and the diversification of supply chains will enable the mitigation and adaptation to climate risks.

The Organic Environmental Code (COA) establishes environmental incentives for conservation, sustainable use and management, and ecosystem restoration, in order to promote the sustainable use of biological resources, promote a culture of pollution prevention and reduction, and compliance with environmental regulations.

"The breakdown of current investment marks 86% public funds and 14% private investment (...) Private financing, (...) is basically allocated to biodiversity offsets, sustainable supply chains and impact investments".

In other words, obtaining measurable biodiversity conservation results that compensate for what has been impacted, obtaining a zero net loss of biodiversity, involves a chain that includes an established strategy and process to identify negative environmental impacts, and a plan to diminish these impacts, and investments that are made with the specific intention of providing a positive environmental impact that is measurable, in addition to a financial return.

The results of the research by [9], who points out that expenditure on environmental management represents approximately 0.34% of the average gross domestic product (GDP) during the study period in Ecuador, show that the country's environmental performance is in an increasing phase of the Kuznets curve, in which environmental degradation tends to increase, but there comes a turning point where economic growth begins to lead to environmental improvement.

An important point from the point of view of the sustainability of companies is the importance that this environmental expenditure not only contributes to the care of the environment, but also to strengthen their permanence in the market, since "The study of environmental costs is a factor that becomes relevant since there are tax incentives for companies that invest in a more ecological and environmentally friendly production" [20].

The study analyzes the relationship between the economic sector and environmental spending. The results obtained through Cramer's V test reveal a moderate association between the economic sector and environmental spending on air care, soil, wastewater and waste treatment. This association suggests that certain economic sectors are contributing significantly to environmental management spending in these specific areas. In this case, when observing the figures, it can be seen that the manufacturing and mining sectors represent the highest proportion in terms of their response, as they do consider these four actions as a current expenditure.

On the other hand, the lack of association between the economic sector and the treatment of radiation, the use of mineral or energy resources and water resources indicates that, at least according to the data analyzed in this study, none of these sectors excels in

regard to their contribution to these challenges, as they do not consider these three actions as a current expenditure.

In any case, in the seven questions examined, the highest proportion of companies answered NO to many of them, this proportion far exceeded the number of companies that answered YES, which implies that, despite the fact that the business sector contributes to Ecuador's economic growth, it is also failing to include environmental spending as a current expense, causing further deterioration to the environment. This finding underscores the need to implement sustainable development policies and strategies that balance economic growth with environmental protection, so that companies implement strategies that not only favor economic and social practices, but also environmental practices, as pointed out by [11].

As for the seven actions aligned to the fight against climate change considered in this study, companies assume them by considering them as a current expense, which implies that it does so on an ongoing basis. In theory, the strategies proposed to do so include: increasing the generation of renewable energy through reducing the current dependence on fossil fuels; improving energy efficiency through the use of energy-efficient electrical equipment (Type A), heat and energy recovery, and recycling; And Monitoring, reporting and verifying emissions through the constant monitoring of emissions and the implementation of corrective measures, when necessary [21].

5. Conclusions

The global pact encourages organizations to voluntarily join together to implement strategies, among which is care for the environment, including climate change. In Ecuador, the Climate Ambition Accelerator program has involved the participation of several large companies and training within the framework of Ecuador Verde.

From the EIAA survey conducted by the INEC in Ecuador, the results show that only a little more than 5% of companies have the ISO 14001:2015 certification. This provides room to adopt strategies for more companies to achieve certification, since implementing standardized standards helps to identify and evaluate the environmental impact and reducing costs, while promoting the operational efficiency and the reputation of the company.

The results show that only a little more than 5% of companies have the ISO 14001:2015 certification, the province with the highest environmental expenditure is Zamora Chinchipe, and the mining sector, with the average of USD 40,000, although there is a very large gap between 75% of the companies that spend the least and 25% of companies that spend the most, with an increase of almost a thousand times, ranging from companies that do have zero expenditure to those that spend more than USD 16 million per year. At the world level, the United Nations establishes that private capital for environmental care should be tripled by 2030 and quadrupled by 2050.

Concerning the seven actions against climate change considered in this study, the reduction of emissions or pollutant concentrations in the air, the prevention of surface water pollution, the prevention of the generation of waste and/or residues, the prevention of infiltration of soil and groundwater pollutants, the reduction or elimination of the negative consequences of radiation, the minimization of the use of mineral and energy resources and the minimization of the extraction of water resources, there is a predominance of companies that do NOT consider them as current expenses. Only in the treatment of wastewater and waste was there a majority of companies in the manufacturing and mining sectors that indicated that these areas are considered as current expenses.

As for the association by means of the Cramer's V test, it was determined that there is a moderate association between the economic sector and environmental spending on air, soil, wastewater and waste treatment, showing that the manufacturing and mining sectors have a significant contribution in relation to the other economic sectors in regard to these four actions and that there is no association between the economic sector and the treatment of radiation, the use of mineral or energy resources and water resources, which implies that none of the economic sectors has a significant contribution in relation to another economic sector in regard to these three actions.

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