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**Socio-environmental Impacts Generated by the Bira  
Mining Company in the Canton of Zaruma, in the  
Period 2017 -2021**

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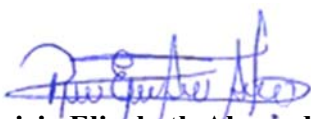
# **Socio-environmental Impacts Generated by the Bira mining company in the Canton of Zaruma, in the period 2017 -2021**

## **Abstract**

This work aimed to determine the socio-environmental impacts generated by the mining company Bira, in the canton of Zaruma during the period 2017-2021. The study used a mixed methodology. Interviews and surveys were conducted to different actors in the mining sector to assess the citizen's perception regarding the impacts generated in their area because of mining. As a result, it was found that mining in Zaruma is perceived as an activity that does not promote sustainable development and does not satisfy the needs of present and future generations.

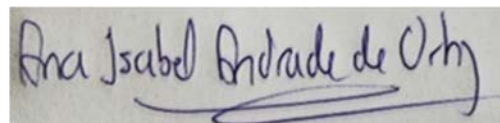
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## Introduction

The growing global environmental crisis has a close relationship between development and the historical dependence on the exploitation of natural resources, mainly mining. In fact, Latin America has one of the characteristic features of a capitalist development, extractivism, where capitalism becomes global and Eurocentric, and over time it has been intended to be represented as sustainable development and economic growth (Quijano, 2015). Development that is only sustained by an extractivist vision based on exploiting natural resources, leaving in its wake different socio-environmental impacts, such as the plundering of communities of their natural heritage, polluting water sources, modifying the natural landscape, modifying the soil, among others (López & Eslava, 2011).

In Ecuador, for example, the presence of mining companies has caused different social conflicts such as the discontent of the people due to their continuous environmental contamination and the appropriation of land and housing (CEDHU, 2013). Following the line of this logic, in the case of mining activity in the province of El Oro, mining has caused damage and environmental impacts to nature and the ecosystem in the highland cantons of the province, reducing the possibilities of preserving a healthy environment (González et al., 2020). Furthermore, according to Henry and Heinke (1999) and Alcívar (2015), mining activity in cantons such as Zaruma and Portovelo has developed in an irresponsible manner during gold extraction, with mercury and cyanide-based treatments becoming part of the 19.45% of water pollution in the province of El Oro. That is why the importance of this work lies in analyzing and identifying the main socio-environmental impacts that the mining company Bira has generated in the canton of Zaruma during the period of 2017-2021. First, literature review of related topics such as the global environmental crisis and mining in its national and international legal context is carried out, followed by the analysis of socio-environmental impacts generated by mining. Next, the perception of the inhabitants of Zaruma is obtained through methodological strategies such as surveys and interviews, in order to know the opinion of the inhabitants of the area of direct influence.

## General objective

Identify the main socio-environmental impacts that the Bira mining company has generated in the canton of Zaruma, in the period 2017-2021.

## Specific objectives

- Investigate the socio-environmental impacts that the mining activity has generated.
- Investigate and recognize the way in which the Bira mining company operates.
- Determine the socio-environmental impacts that the company has generated in the canton of Zaruma in terms of the SDG 2030.

## Theoretical Framework and State of the Art

### Global Environmental Crisis and the Influence of Mining

The Industrial Revolution is considered one of the milestones that generated the greatest economic, sociological, technological and cultural changes in the history of humanity, and has undoubtedly been known for substantially affecting the relationship between man and nature (Navarro, 2015). As a consequence of this revolution, environmental problems at local and global level increased, causing unbridled economic growth with collateral effects due to industrialization, and generating as a consequence an environmental crisis (Beck, 1998). This crisis is defined as the impossibility of nature to reproduce itself at the same level as society generates its alterations (Foladori, 2001); therefore, this crisis affects the environment due to the irresponsible interaction of man with his natural surroundings, which affects in a general way the conditions of life in the ecosystems that make up the planet. This crisis is expressed in the loss of biodiversity, deforestation, pollution and water stress, soil degradation, and climate change (Bravo, 2013). Faced with this scenario, a team from MIT (Massachusetts Institute of Technology), led by Dennis Meadows, published *The Limits of Human Growth* in 1972, a report in which five basic factors limiting the growth of planet

Earth were studied, such as: production, population, agricultural production, industrial production, pollution and natural resources (Zaragoza, 2009).

This report shows how development has been based on exponential growth as a result of the fact that humanity has only focused on material development, without considering the environmental, social, cultural, and economic effects that this generates. It was in view of these effects that the world political agenda was formally established and the reason why the United Nations Organization incorporated efforts to raise awareness of the problem of the global environmental crisis. Thus, the Stockholm Conference on the Human Environment in 1972 became a fundamental milestone, since from then on the environmental crisis was treated as a real macro-problem, which focused international attention on environmental issues as a guide to preserve and improve the human environment. Another milestone that was generated is the Brundtland Report 1987, where the concept of sustainable development arose and gave visibility to the economic, social, and environmental problems that the world has been facing for decades, as it consists of three dimensions, economic, social, and environmental sustainability while contrasting the problem of environmental degradation that is common to economic growth, and at the same time the need for that growth to alleviate poverty (WCED, 1987). In other words, the sustainable development proposal seeks to satisfy the needs of the present without compromising future generations.

In addition, it was incorporated in all UN programs and served as an axis, for example, at the Rio Summit in 1992, a conference known as the Earth Summit, which became a turning point in international negotiations on environmental and development issues. It adopted 27 principles that focused on integrating economic development and environmental protection. In other words, this Summit did not criticize production, the world economic order, or development, but rather urged that economic development should be sustainable and thus achieve a balance, since social, environmental, and economic needs must be balanced against each other to achieve sustainable long-term results. Thus, these milestones are understood as part of a continuum between environmental disasters, social movements, development of environmental multilateralism, and theoretical debates, which have made visible the global scale of the crisis, which today it is easy to conclude, was unleashed by the irresponsible interaction of man with his natural environment (Guimarães, 2001). For this reason, they saw the need to outline a development model that guarantees equity in the access and use of natural resources, seeking to establish international agreements on overcoming variables such as pollution, depletion of natural resources, loss of biodiversity, climate change, depredation of forests, and non-renewable fossil fuels. They also established the need to address indolence in the face of the use of biotic and abiotic elements, heavy machinery, the misuse of soils and the depredation of natural resources, in the sense of taking over non-renewable or renewable resources at rates higher than the capacity of ecosystems to replenish them, and above all, the direct depredation that occurs with the legal and illegal mining industry (Navarro, 2015).

Mining is considered an economic activity that includes the process of extraction, exploitation, and use of minerals found on the earth's surface for commercial purposes (Banco Central del Ecuador, 2015). Depending on the mineral and the type of extraction, mining can affect water resources in many ways, from the contamination of groundwater and surface water sources to the alteration of surface and groundwater flows, the use of significant volumes of water, which directly or indirectly affect the availability of water for the consumption of people and communities surrounding the projects, or the use in other economic agricultural and livestock activities (IPBES, 2019).

Specifically, with gold mining, mercury (Hg) is used as an extraction mechanism and is one of the main heavy metals that pollute aquatic systems because it contains an extremely toxic ionic compound, which is responsible for polluting and is known for its high impact on aquatic biota (Clarkson & Magos, 2006). With this context, it can be evidenced that mining has a great influence on this environmental crisis, since this activity uses a resource found in the subsoil, which disturbs and modifies the surface condition of the soil, and with it, all its natural biota. In this sense:

Over time, mining has been wreaking havoc on the environment due to the disturbance and destruction it causes in the natural environment, affecting and reducing non-renewable natural resources and altering the ecosystem of the areas, either slowly or imperceptibly. Mining has also generated changes in the social and natural environment, producing adverse effects on the environment and generating or exacerbating socio-environmental conflicts. Impacts can be indirect, direct in the long, medium, and short term. Altering the quantity and quality of water, affecting fauna and flora, destroying strategic ecosystems, affecting infrastructure, as well as the transformation of lifestyle in local communities, in economic, social, and cultural spheres reflecting the effects left by such activity (Defensoría del Pueblo, 2016).

## Environmental Crisis in Ecuador

Historically, the extractive economy has characterized the development and economic history of Latin America. In fact, a characteristic feature of capitalist development in Latin America is extractivism, especially because, according to Quijano (2015), until these days, there is a trace of colonialism in the way power and modernity are put in place in Latin America while capitalism becomes global.

Extractivism is an economic activity that, under intensive practices, removes large volumes of natural resources, which are mostly acquired to be exported as raw materials or food to global markets, without being processed or being processed to a limited extent (Gudynas, 2013). For Instance, extractivism is used as a modality of economic growth which is based on the appropriation of nature. The accelerated growth of natural resource extraction has caused environmental problems because it entails strong economic, social, and environmental impacts, which generate unrest and conflicts with communities as a result of the environmental crisis (Acosta, 2009; Bebbington, 2009; Gudynas, 2009),

which, as previously analyzed, has consisted of accelerated global processes of destruction of nature, that is endangering the existence of life. Socio-environmental conflicts arising from large-scale mining constitute one of the fundamental issues in the contemporary mining debate, as numerous studies show the growing conflict associated with large mega-mining projects, especially in Latin America (Bebbington, 2009; Gudynas, 2009; Martínez, 2001). In the Ecuadorian context, extractivism plays a role, since it has been established as a development model since the 1980s, turning metallic mining into an economic pillar (Acosta, 2009; Alvarado, 2016).

Currently, large-scale metallic mining in Ecuador is an economic activity on which the national government has bet due to the great mining potential that the country has. The negative aspect of large-scale mining is that it has brought numerous ecological and environmental conflicts which, according to Santandreu and Gudynas are “a particular type of social conflict where the issue in dispute is the environmental and social aspects such as the people’s quality of life.” (1998, p. 16) This has led to emblematic cases, such as the "*Cobre Mirador*" mining project, located in the canton of Pangui, where the Canadian company Corriente Resources is exploiting the copper deposit and became the first example of large-scale exploitation in Ecuador, with a series of impacts that will greatly affect the area and the socioeconomic and cultural activities of the canton. Table 1 shows the environmental, social, and economic socio-environmental impacts caused by the Mirador Project mining company:

**Table 1**  
*Socio-environmental impacts - Mirador Project*

| Social   | Environmental   | Economic   |
|--|---|--|
| <ul style="list-style-type: none"> <li>- Lack of socialization of the Territorial Planning Plan (PDOT).</li> <li>-Transportation shortages in rural neighborhoods and Shuar community</li> <li>- Alcoholism in young people</li> <li>- Population division</li> <li>- Domestic violence</li> <li>-Purchase of land by the mining company.</li> <li>- Early pregnancy.</li> <li>- Migration.</li> <li>- Theft.</li> </ul> | <ul style="list-style-type: none"> <li>- Water pollution, due to lack of garbage collection</li> <li>- Burning of inorganic garbage.</li> <li>- Felling of trees.</li> <li>- Destruction of forests.</li> </ul> | <ul style="list-style-type: none"> <li>- Economic dependence on the mining company.</li> </ul> |

*Note:* This table shows socio-environmental impacts - Mirador Project.  
Source:(Sánchez et al., 2016).

In this context, it can be seen how these socio-environmental impacts have contaminated and affected the healthy environment. People with a pro-mining stance felt confident that the mining company would comply with its obligations, whether in terms of social and labor conditions, or environmental aspects. However, in reality, they prioritized certain socioeconomic aspects for the canton, without considering the environmental consequences. This is a pattern that is often repeated when analyzing the socio-environmental conflicts of large-scale mining projects, that is, the distribution of economic benefits is one of the key factors in the evolution and generation of conflicts (Arellano Yanguas, 2012).

### **Mining in Ecuador since the 2008 Constitution.**

With the enactment of the 2008 Constitution in Ecuador, the rights of nature emerged as a response to the environmental crisis, where the political effort to recognize Nature as a subject of rights was embodied in the Magna Carta and, for the first time, constitutional norms are contemplated that make it possible to demand full respect for Nature. Therefore, they are recognized as Rights of Nature. These are presented in articles 71 and 72, and can be complemented with indications on their application, restrictions, precautions, etc., contained in articles 73 and 74.

Although Art. 74 recognizes that individuals, communities, peoples and nationalities have the right to benefit from the environment and natural resources that allow them to live well (Constituent Assembly, 2008), Art. 71 states that its structure must be maintained and its vital cycles must be fully respected (Constituent Assembly, 2008). In this regard:

Article 72.- Restoration is a right that nature has, which may be independent of the obligation of the State and legal or natural persons to compensate the collectives and individuals that may depend on the affected natural systems (Constituent Assembly, 2008). And it shall apply restriction and precautionary mechanisms to mitigate or eliminate the destruction of ecosystems and the permanent alteration of natural cycles Art. 73 (Constituent Assembly, 2008).

Additionally in this political pact, in Article 14:

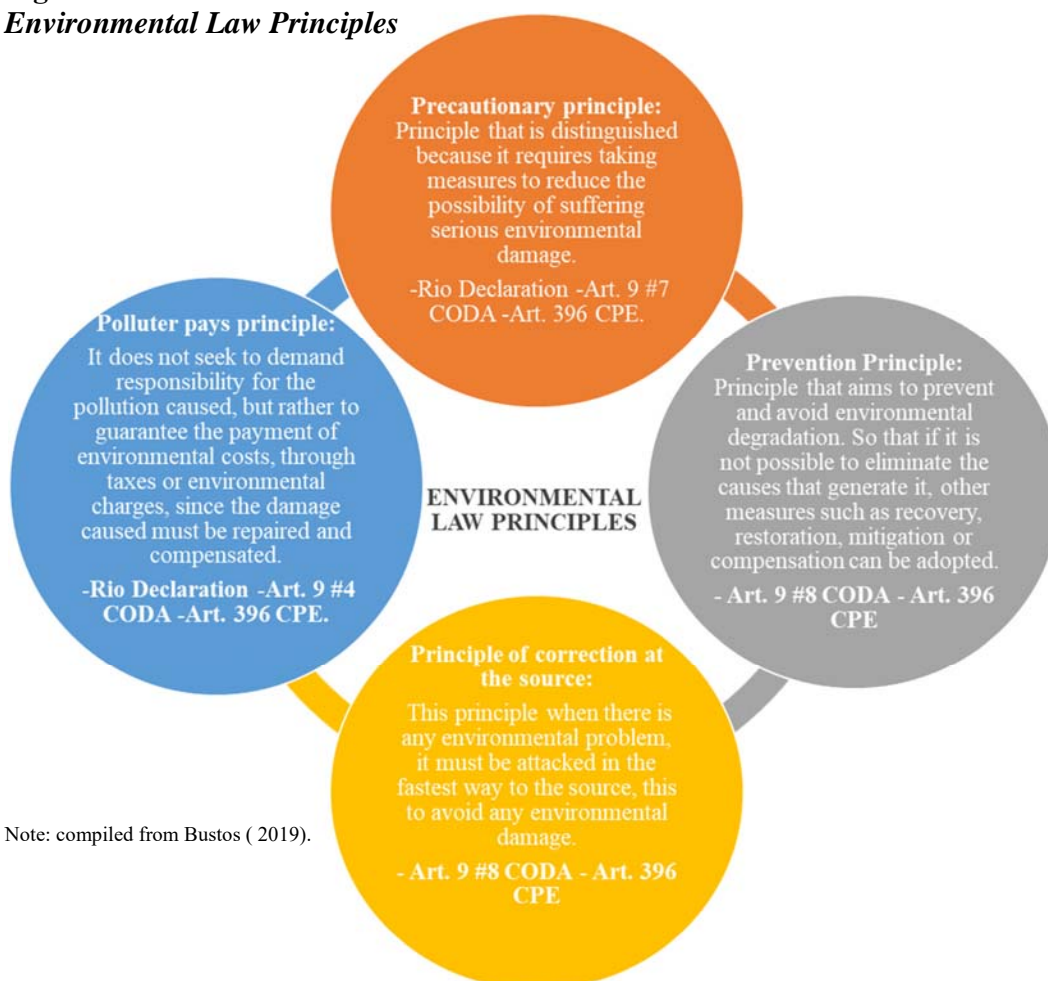
The right of the population to live in an ecologically balanced and healthy environment, where good living, *sumak kawsay*, and sustainability are guaranteed, is recognized. Which declares that it is of public interest the conservation, preservation of ecosystems, integrity and biodiversity of the genetic heritage of the country, as well as the recovery of degraded natural spaces and the prevention of environmental damage (Asamblea Constituyente, 2008).

That is, the Constitution of the Republic (2008) began to break paradigms moving from the human being as the only subject of law, and giving way to a new conception with a biocentric approach, which has as its primary purpose to protect nature, which became the new subject of law Art.10 (Constituent Assembly, 2008), and the right to a healthy environment derived from the doctrine of *sumak kawsay*. Therefore, the Constitution refers to the integral protection of nature, which encompasses environmental protection, which goes beyond protection in the administrative sphere to be part of a multidimensional protection, which involves environmental restoration, which seeks to mitigate and eliminate the harmful environmental consequences caused by damage.

Likewise, the Constitution, with the purpose of guaranteeing the model of good living, recognizes a set of environmental principles as can be seen in Figure 1.

**Figure 1.**

***Environmental Law Principles***



Note: compiled from Bustos (2019).



In this context, in 2008, the National Constituent Assembly of Full Powers issued Constituent Mandate Number 6 with the objective of preventing environmental, social, and cultural impacts; it was also a political-legal result of social demands and demands against large-scale mining (CEDHU, 2016). This mandate arose in response to the chaotic situation of the extractive policy in Ecuador, as the process of expansion of the extractive frontier affected rural, peasant, and indigenous territories and the ecosystems on which populations living in their vicinity depend. It was a mandate of complex deliberations and discussions, especially within the ruling party and president Rafael Correa's government, since it was the response to the demands and claims that the popular anti-mining environmental movement expressed in rejection of large-scale industrial mining, after two decades of struggles and resistance (Sacher & Acosta, 2012).

The mining mandate could cease concessions without any economic compensation if mining companies incurred in the following:

1. Non-compliance with the obligations established in the law regarding investments and payment of patents.
2. Absence of environmental consultation processes or consultation with indigenous peoples and nationalities.
3. Affectation of water sources and springs.
4. Impact on the National System of Protected Areas.
5. Land grabbing, prohibiting the same person, company and its subsidiaries from holding more than three concessions (Acosta & Hurtado, 2016).

However, the Mining Mandate was only an ephemeral legal instrument, since, in the following months, the former president, Rafael Correa would express his position in favor of large-scale industrial mining. Thus, he moved away from the anti-mining social demands on which, among others, he sustained his electoral campaign and government plan of 2006 and caused the National Government to distance itself politically from the anti-mining social and political demands and to focus on the dialogue with national and transnational mining companies to coordinate the issuance of a legal regulatory framework for mining activity. In fact, on November 14, 2008, the President sent the draft Mining Law to the Legislation and Oversight Commission, which assumed legislative functions after the end of the Constituent Assembly's activities (Acosta & Hurtado, 2016).

The National Government's call to the "National Mining Dialogue," which included mining companies, provoked the organized communities to once again take up the struggle against mining projects, given the clear promotion of a medium and large scale mining policy coming from a socially legitimized government that had pronounced a political discourse announcing responsible mining. While the legislative process for the approval of the law was advancing, since May 2008, protests resumed due to the possible non-compliance with the Mining Mandate and the imminent approval of a new Mining Law, which, under the principles of sustainability, precaution, prevention and efficiency, aims to control, manage, and regulate the Ecuadorian strategic mining sector (Mining Law, 2009).

In this context, its creation and approval lays the foundations for the development of large-scale mining, with the exercise of mining rights and the exploitation of natural resources (Rodríguez, 2016), since one of its base objectives is the increase of economic production of the state, understood in this context as an economic activity in charge of exploiting, extracting and taking advantage of minerals for international demand (Mining Law, 2009), leaving aside the claims of the peoples, communities, and nationalities that are affected by mining. In other words, this mining law violates the rights of nature due to the fact that it does not seek the true sense of good living, as it risks the natural regenerative cycles of the ecosystem and promotes open-pit mining (Acosta & Hurtado, 2016).

Thus, the government, forgetting the principle of good living, since January 2009 has allowed the development and implementation of large-scale mining projects with the objective of achieving "development." Some of these projects are called the strategic ones, among which are Mirador and Fruta del Norte, Loma larga, San Carlo Panantza and Rio Blanco; in addition to projects called second generation among which are Cascabel, Cangrejos, Ruta del Cobre, Llumiragua, Curipamba and La Plata.<sup>1</sup>

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<sup>1</sup> These mining projects are called second generation because they are additional projects to Mirador and Fruta del Norte, as they are part of an economic reactivation plan, extractivism. For this reason, after several periods of exploration and economic evaluation of the deposit, the projects Cascabel (Imbabura), Cangrejos (El Oro), Curipamba (Bolívar), Llumiragua (Imbabura) and Ruta de Cobre (Azuay), are projects that could

These large-mining projects are promoted by the mining law, thus commodifying nature and its elements, since projects as Fruta del Norte, owned by the company Aurelian Ecuador S.A, located in the province of Zamora Chinchipe (Mining, 2017), evidence different affectations in nature, such as water pollution caused by chemicals that the company uses and flows into the rivers in the area, product of the extraction of precious metals; deterioration suffered by the soil, since after the area is eroded, it cannot return to its natural state; and finally, air pollution which is caused by the use of gasses, which go directly to the biosphere. All these impacts are found in an important area, i.e. a subtropical rainforest (Orellana & Gonzalo, 2011).

Another case in which it has affected communities and the environment in Ecuador is El Mirador, located in Zamora Chinchipe, and which belongs to the company Ecuacorriente S.A. The minerals it exploits are gold, copper and silver (Minería, 2017). The company carries out its extractive activities in the territories of native peoples, with impacts such as deforestation, river contamination, and soil erosion (Ramón et al., 2022). In addition to affecting the Tundayme community through mining activities with the aforementioned impacts, the project is developing its mining activities in the Cordillera del Cóndor, which is characterized by its delicate and extensive biodiversity in the region (Garbay, 2011).

### **Socio-environmental impacts generated by mining**

On a global scale there have been terrible effects on the environment and health due to mining. In other words, mining has brought exponential changes to the environment. Orellana, et. al. state that "the impact of this extractive activity on life-support systems is putting at risk the existence of various forms of life, including the survival of humanity itself." (2020, p. 17) This is due to the fact that megaprojects base their productive activity on extracting and exploiting natural resources of mineral origin, which cause the destruction of agricultural production and the plundering of the natural heritage of the communities, through socio-environmental impacts that modify the original landscape of the land and contaminate water sources, i.e. an unsustainable extractivist boom that only seeks to commodify nature (López & Eslava, 2011).

On the other hand, although mining activity "energizes" the economy, such effect is fleeting since, according to ECLAC data, in recent years there has been a "re-primarization" of exports, which means that Latin America has become vulnerable and dependent on the price of metals, suffering from the most negative aspects of this extractive activity, such as the scarce productive diversification, which has been generated by the displacement and delay in other economic activities (ECLAC, 2013). That is, the mining industry by its nature of non-renewable resources, is not a sustainable activity; however, institutions play an essential role in the economy of nations (Salazar, 2016), causing that political and economic power to base its activities on extractivism, an economic model and human activity that in society is very often considered as a guarantee of sustainable development and progress (Carrasco & Fernández, 2009).

In addition, mining generates employment, but of poor quality, since in most cases fatal accidents arise due to minimal safety. According to the International Labour Organization (2018) mining is considered a hazardous occupation, despite the efforts made globally. Since the work inside the mine generates a high risk to workers that is always present due to explosives, sudden movements, collapses, injuries, diseases in workers, and death rate, which happens despite the use of appropriate tools, i.e., the risks are always latent.

In Ecuador, these socio-environmental impacts associated with mining have caused the interests and rights of the inhabitants not to be respected, as they have generated social, economic, and environmental problems, such as the appropriation of the inhabitants' lands, the discontent of the inhabitants due to the continuous contamination of the

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contribute 4% of the country's GDP, and according to the Ministry's communiqué, in 2023 the Curipamba (gold) and La Plata (gold) projects would enter the exploitation phase, while in 2025 the Cascabel (copper) project would enter the exploitation phase. These projects, according to the Government, through the Ministry of Energy and Non-Renewable Natural Resources, are promoted with responsible processes that respect the environment and people, through high technical standards (Ministry of Non-Renewable Natural Resources, 2010).

environment, the lack of respect for their integrity, the loss of biodiversity, health impacts, climate change with massive deforestations associated with mineral extraction (CEDHU, 2013). Additionally, among its main impacts is the excessive use of water required for its operation, causing the contamination of water sources, since approximately one cubic meter of water is needed as well as the use of heavy metals during the extractive process (Machado, 2010), which makes water sources unusable for human consumption and agriculture. In this context, another risk that mining presents according to González et al., (2020), is the use of metals such as mercury, cadmium, lead, cyanide, arsenic, among others, since they are toxic and negative for the environment. These contaminating elements are used to separate precious metals from rocks and are then deposited in water sources, making them unusable because they are toxic for humans and even worse uninhabitable for aquatic life, especially fish (Moran, 2013).

Within this context, the city of Zaruma is located in the province of El Oro, Ecuador. Zaruma was named by UNESCO as Cultural Heritage of Humanity, and is known for having an economy that is based on extractivism (Ministry of Tourism, 2018), which dates back to aboriginal times (Ayala, 2008). This intense extractive activity for years has not considered the planning of mining and urban development, causing the population to live in areas near processing plants and inactive and active mining operations. In addition to affecting the stability of the terrain, these operations in populated areas bring social impacts, as they put the community at risk due to the appearance of sinkholes, which have been causing buildings and schools to sink, thus destroying heritage and causing economic impacts because the economic sources that are based on tourism are affected in their entirety (González et al., 2017). In addition, according to Orellana, Briére and Rodríguez (2020) all the resources used to carry out the extractive activity have brought with them a number of negative impacts to the environment, due to the use of heavy metals, the excessive use of water, and soil deterioration, which have caused the modification of the landscape and water pollution. In the case of Zaruma, this occurs due to the discharge of mine water without any prior treatment, thus contaminating the watercourse; the improper use of water that produces an imbalance of water balances; the improper handling of chemicals, which are often disposed of directly into the water; as well as other impacts generated by industrial activity on the environment, which endangers the existence of various forms of life, including human life (MAATE, 2021). This led the Government of Ecuador, on September 14, 2017, to declare Zaruma in a state of emergency for sixty days, due to the undermining of the subsoil of the city's heritage. This in order to inspect the 45 concessions located in the area surrounding Zaruma, where according to President Guillermo Lasso, many of the legal mining concessions developed illegal activities under the city.

## Methods

The methodology used in this research work is mixed and includes qualitative and quantitative strategies. It is based on a case study according to the author Robert Yin, who points out that the case study is an empirical investigation that studies a contemporary phenomenon within its real context, especially when the limits between the phenomenon and its context are not clearly evident (Yin, 1984). Among the strategies for the analysis of the case, the triangulation of data sources, and quantitative and qualitative methodologies together with a bibliographic and documentary analysis were used. Qualitative, which according to (Taylor & Bogdan, 2000), is characterized by being inductive, which explores the phenomena in depth where concepts and comprehensions are developed from data patterns, which in this case helped to identify the perception of the citizens on the socio-environmental impacts, for which 50 surveys directed to the population were used and complemented with quantitative information through 2 semi-structured interviews linked to the Municipal Government of Zaruma and the mining company. These interviews revealed the perception of the citizens and determined the socio-environmental impacts that the Bira mining company has had on the Zaruma community.

## Case Study

Bira Bienes Raíces S.A, is an Ecuadorian mining company with more than 35 years of experience, located in Zaruma province of El Oro, which aims to develop mining work in an efficient, responsible and safe manner in order to extract different types of minerals such as gold, silver and copper (Bira, 2015). In addition, the Ecuadorian State, through the Ministry of Non-Renewable Natural Resources, granted it the Concession Title for Metallic Minerals in

the area called "Palacios," which gives it the right to explore, smelt, process, commercialize, and close mines of metallic mineral substances that may exist and be obtained in the area formed by 70.36 mining hectares, located in the canton of Zaruma, province of El Oro (Ministerio de Recursos Naturales No Renovables, 2010).

The Bira company has a processing capacity of 300 tons per day with a subway mining method, which is based on cut and fill, by which the rocky material (minerals) that contain gold, silver and copper are extracted. After extraction, this material is transported to the plant where it enters the process of refining for trade. The company has an approximate production of 336 kg (Atiencia, 2019). In addition, Empresa minera Bira has received environmental excellence awards in 2000, 2002, 2004 at the Organismo Latinoamericano de Minería (Olami) competition, Santiago de Chile, for complying with environmental guidelines, such as environmental education programs, reforestation programs, strict waste management in water, soil, and land clearing, in order to manage sustainable mining in the community (Bira, 2015). The Company has an Environmental Management Program, which focuses on ensuring proper environmental management through environmental education programs for proper waste management, as well as a waste management program that consists of temporary storage and sorting in the municipal collection cart. It also has a water management system, for which water monitoring is performed; and according to the company, they have suitable infrastructure, with septic tanks, sedimentation pools, and a water treatment plant (Bira, 2015).

Regarding wastewater management and how to prevent and mitigate socio-environmental impacts during extraction, the interviewee commented that the Bira mining company does the following:

*We do daily monitoring of the water that comes out inside the mine, that is to say we have a decantation plant where it is processed and treated so that the water comes out much cleaner than what comes out in mine, since it is very acidic, so the water is pumped and comes out to a decantation pool, where it is treated, and apart from that the solids are recovered, which allows the water in the upper part to be relatively free of contaminants and lets the water continue its course to the stream without any environmental damage. In addition, we have reforested more than 70 hectares of trees, which has helped to maintain an adequate visual landscape without much loss of biodiversity. And in terms of mitigating socio-environmental impacts we take many actions, one for example is to give talks to our miners and different mining companies, to perform proper mining, proper handling of explosives to avoid accidents etc.. So we focus more on the part of how to mitigate socio-environmental impacts and do responsible mining that avoids any kind of impact on the community and the environment (Personal communication, June 16, 2022).*

With this scenario, according to the Ministry of Environment, Water and Ecological Transition (2021), the Palacios mining concession with code 158, has the corresponding Environmental Management Plan since, according to their inspections, they have verified that the mine water generated in the concession is conducted to pools where water is conditioned by injecting lime slurry, which is used to neutralize the acidity and eliminate impurities, and solid waste is previously stored and disposed of in separate containers. This is also true for their powder magazines, explosives, and detonators, which have adequate ventilation and techniques (differentiation, protective cover, waterproofed floor, and signage).

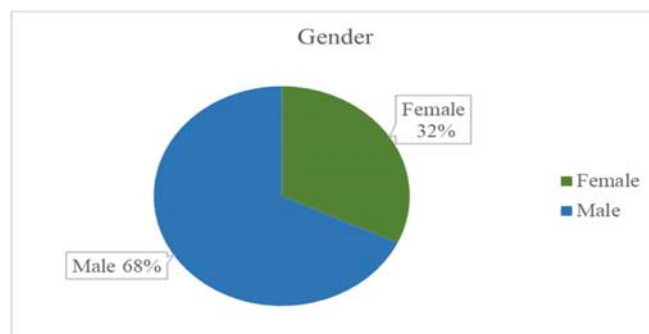
## Results

In order to determine the population's perception of the socio-environmental impacts generated by the Bira company, 50 surveys were conducted with residents directly linked to the company's mining activity, and 2 interviews were conducted with people linked to the Zaruma Municipal Government and the mining company.

Thus, of the people surveyed it is evident that the majority are male, as shown in (Figure 2). In addition, it has been identified that their main economic activity is mining, followed by commerce and tourism, as shown in (Figure 3), without agriculture and livestock activities.

### Figure 2

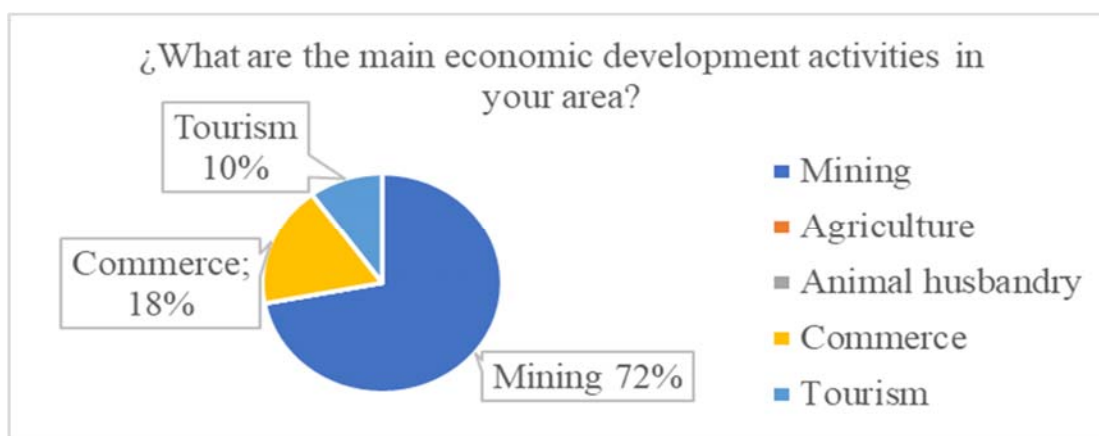
#### Gender



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 3

¿What are the main economic development activities in your area?



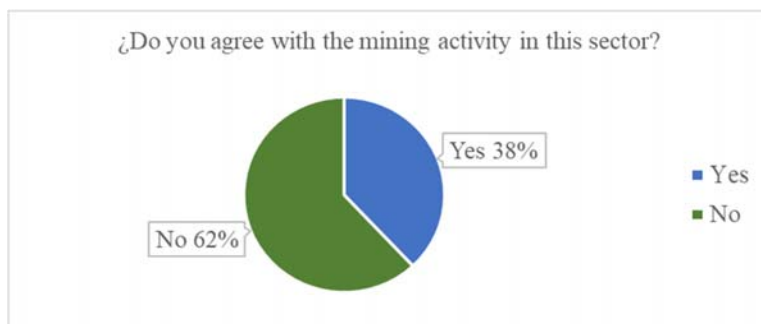
Source: (Perception of socio-environmental impacts, June 11, 2022).

In this context, the perception of the mining activity has been consulted, obtaining as a response that 62% do not agree with the extractive activity, because they consider that it does not generate sustainable development, as can be seen in Figure 4, Figure 5, and Figure 7; and because it is not possible to have a responsible mining, something that 65% of respondents state (see Figure 6). This information differs from what the mining company, when it states that:

*We prevent it by incentivizing that you can have responsible mining with the environment, it is for that reason that we have received several awards such as, the Environmental Excellence Award II Contest Latin American Mining Organization (Olami), Santiago de Chile in 2000, 2002, 2004, so that we consider that is an adequate way to prevent, also we try to resort by all possible processes to avoid any type of pollution such as treating water recycle, reforest, take care of our staff, make talks etc. (Personal communication, June 16, 2022).*

### Figure 4

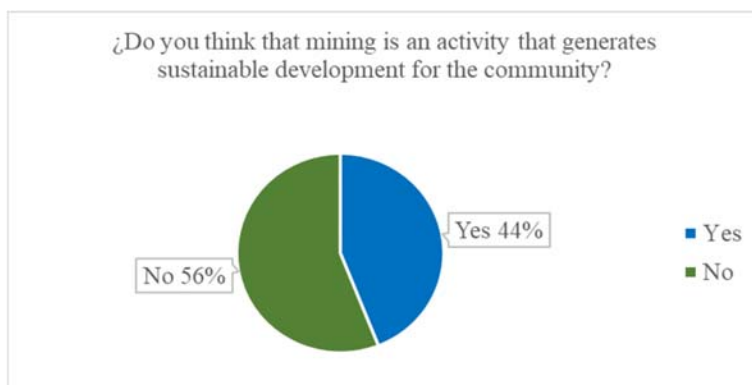
¿Do you agree with the mining activity in this sector?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 5

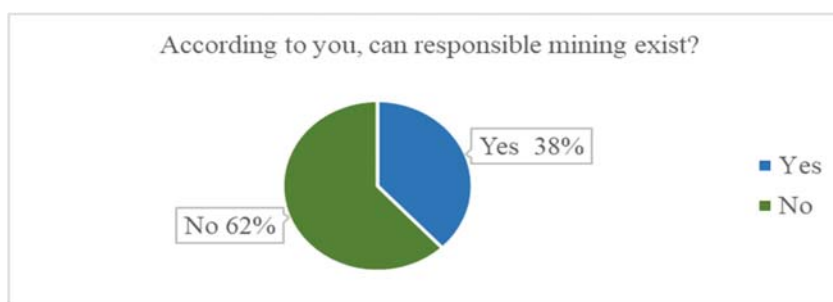
¿Do you think that mining is an activity that generates sustainable development for the community?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 6

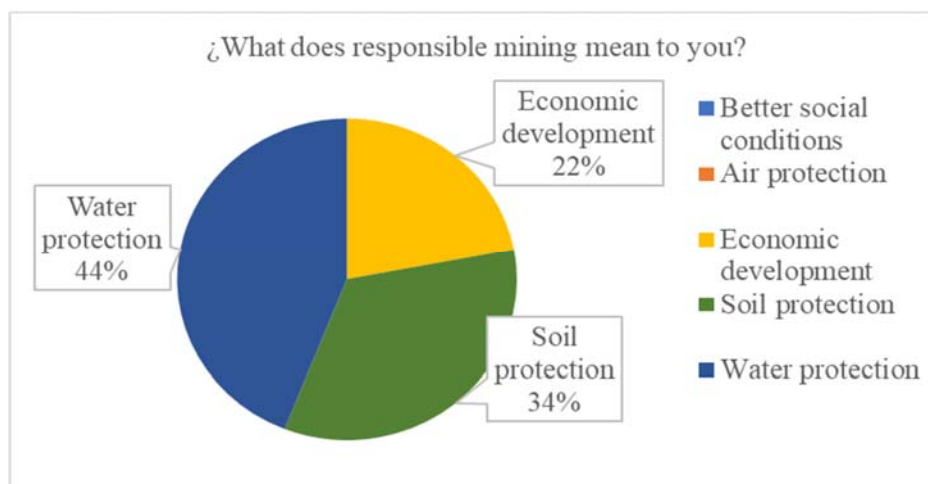
According to you, can responsible mining exist?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 7

¿What does responsible mining mean to you?



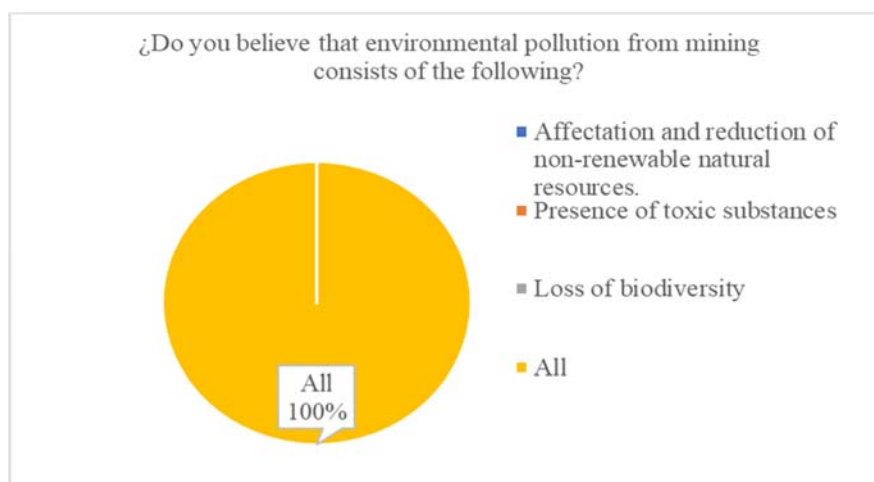
Source: (Perception of socio-environmental impacts, June 11, 2022).

### Environmental Aspect

Entering into the analysis of environmental impacts, some consultations have been made in the survey, from which it is identified that for those surveyed, environmental pollution from mining is caused by the affectation and reduction of non-renewable natural resources, presence of toxic substances, and loss of biodiversity.

### Figure 8

¿Do you believe that environmental pollution from mining consists of the following?



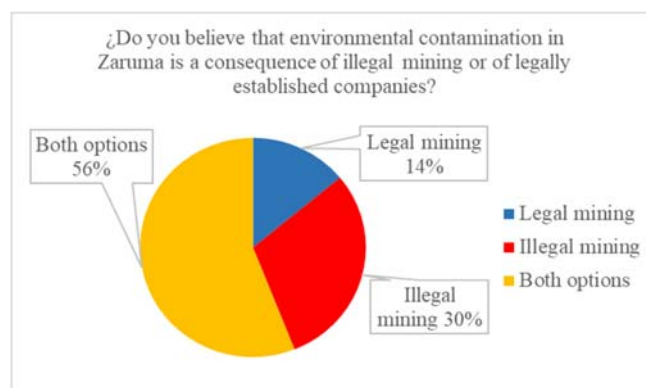
Source: (Perception of socio-environmental impacts, June 11, 2022).

And this is corroborated when the surveyed questions state that "the Bira mining company prioritizes socioeconomic benefits over environmental impacts". Since the following environmental impacts have been generated, water scarcity, the appearance of mining waste, which are not disposed of in appropriate places, but go directly into the water, damaging water resources, data shown in Figure 8, Figure 10, Figure 11, Figure 12. In addition, as main impacts,

considered by the respondents, are undermining, damage to the visual landscape, extinction of fauna, massive deforestation, exploitation of resources and loss of biodiversity (see Figure 14). According to those surveyed, this is due to the fact that 30% is due to illegal mining and 14% to legal mining and 56% to both options (see Figure 9).

### Figure 9

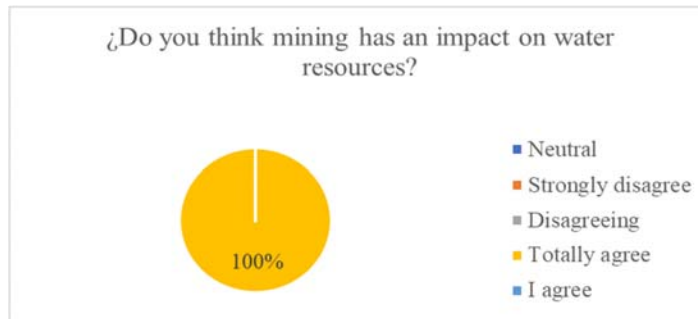
¿Do you believe that environmental contamination in Zaruma is a consequence of illegal mining or of legally established companies?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 10

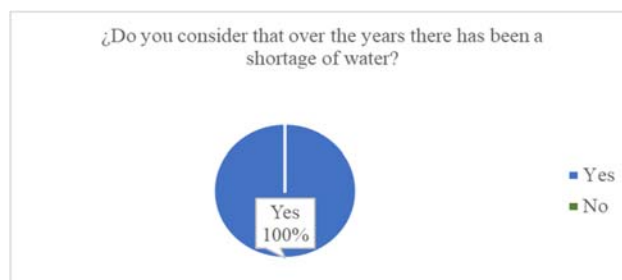
¿Do you think mining has an impact on water resources?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 11

¿Do you consider that over the years there has been a shortage of water?





Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 12

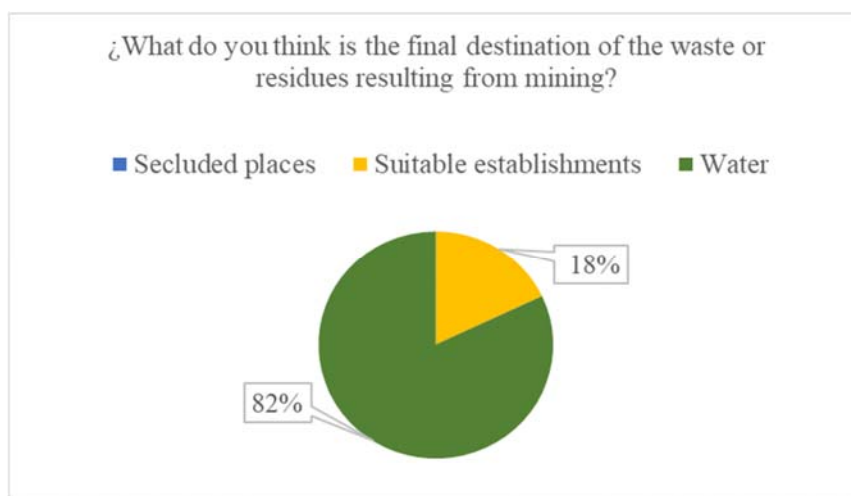
¿Have you noticed the accumulation of mining waste around the Bira company?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 13

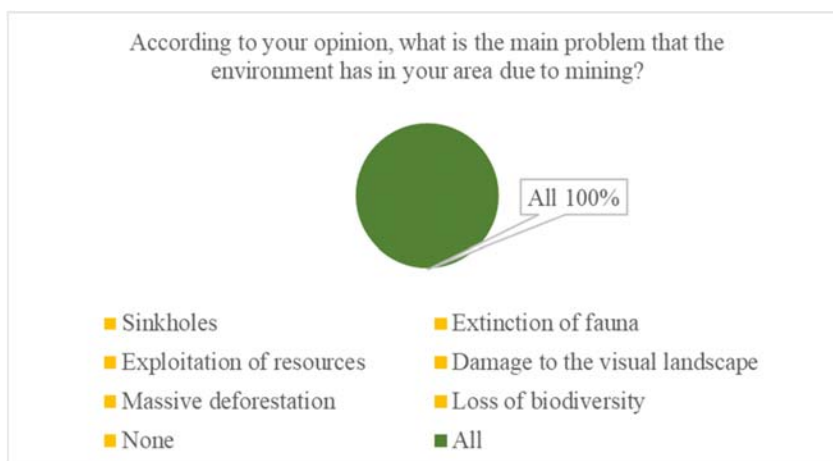
¿What do you think is the final destination of the waste or residues resulting from mining?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 14

According to your opinion, what is the main problem that the environment has in your area due to mining?



Source: (Perception of socio-environmental impacts, June 11, 2022).

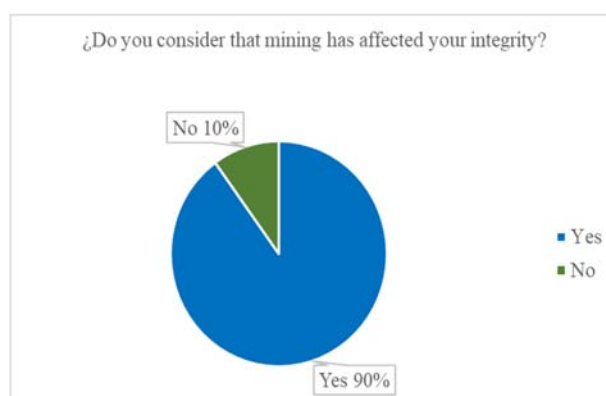
### Social Aspect

Regarding the social aspect, the people surveyed consider that their integrity has been affected by the lack of regulation by the municipal entities, this is evidenced in Figure 15, Figure 16, Figure 17, Figure 18, when they state that they have the following health problems: Affected vision, hearing impairment, severe headaches and respiratory problems (see Figure 19) this differs from what the mining company, when it states that:

*We have a high safety system, the worker from the moment he enters must go through interview and medical processes to know if he is fit to work, for example, in the case of an elderly person, he can no longer enter the mine, but he can perform other work suitable for his well being. In addition, we have helmets, goggles with special mesh so that they do not get stones while drilling, so in every sense we have all the equipment depending on the activity that the worker performs, instruments that obviously we provide them in the company* (Personal communication, June 16, 2022).

### Figure 15

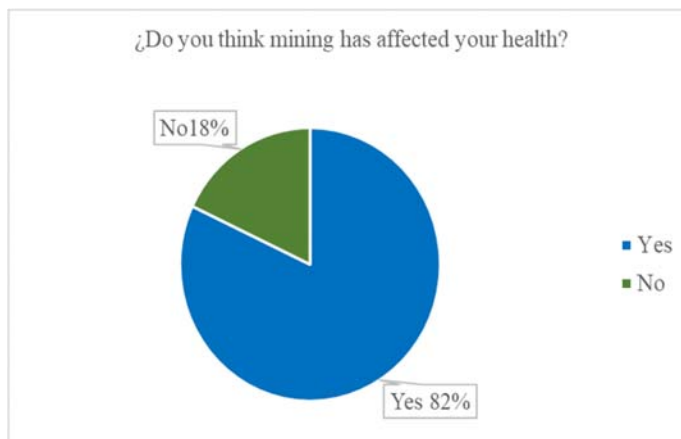
¿Do you consider that mining has affected your integrity?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 16

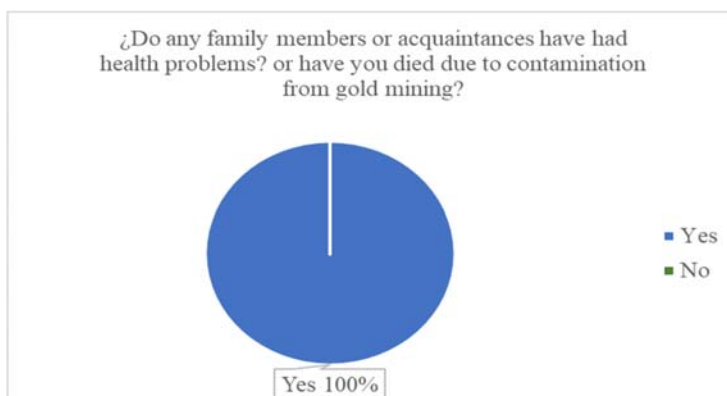
¿Do you think mining has affected your health?



Source: (Perception of socio-environmental impacts, June 11, 2022).

**Figure 17**

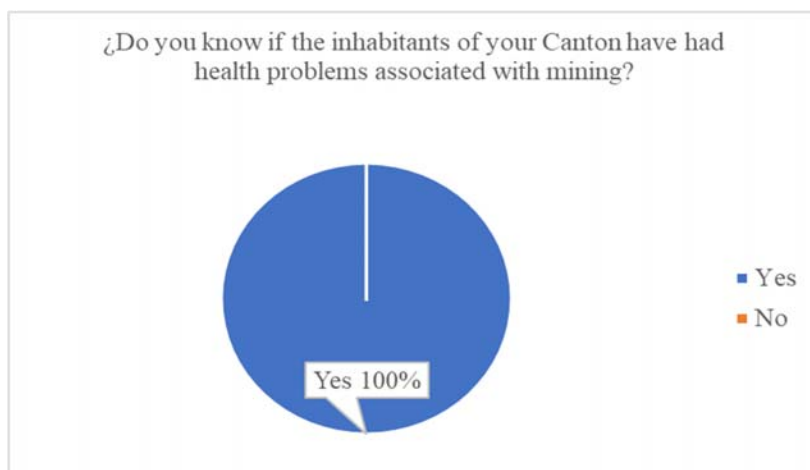
¿Do any family members or acquaintances have had health problems? or have you died due to contamination from gold mining?



Source: (Perception of socio-environmental impacts, June 11, 2022).

**Figure 18**

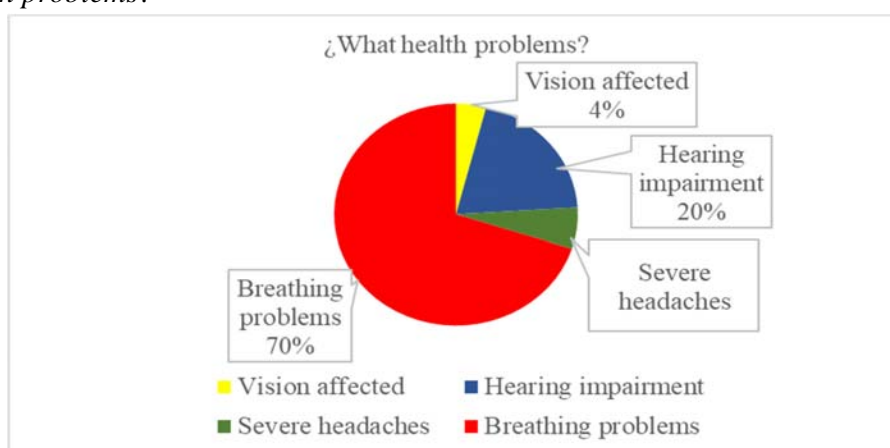
¿Do you know if the inhabitants of your Canton have had health problems associated with mining?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 19

¿What health problems?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Economic Aspect

Entering into the analysis of the economic impacts, some queries have been made in the survey, from which it is identified that for the respondents, mining is not a good source of employment (see Figure 20), rather they consider that over time a dependence on it has been created (see Figure 21).

With that context, respondent number 1 states that:

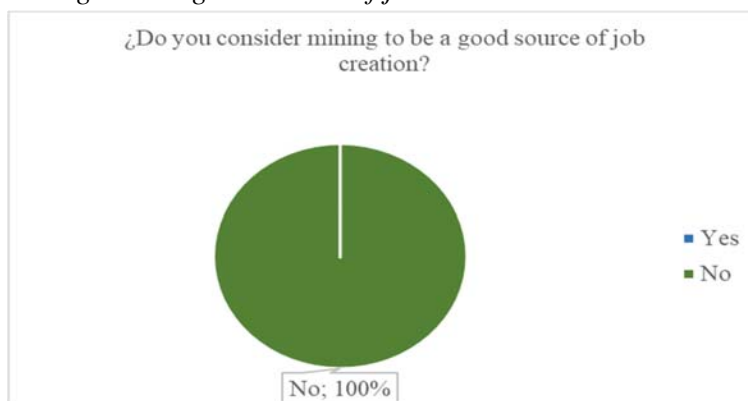
*As for, if it is a good employment generator, in my criteria it is very personal. Mining is a dangerous job, but it is related, at least I believe in 70% of the sources of employment either direct or indirect because it has been seen that when mining is booming, the economy of even the smallest store is energized on the other hand, when we do not have mining, I think we are all affected, whether we are miners or not, then I think it is something by idiosyncrasy itself that we depend almost 100% on mining." (Personal communication, June 12, 2022).*

In other words, it is evident that there is a very strong dependence on mining in the area, according to the surveys and the interview. In addition, 92% consider that mining projects contribute to economic development (see Figure 22), but state that "there is indeed a 100% dependence on mining, and even more so due to the destruction of tourist sites such as the center and main avenues, which has generated negative effects on the community dedicated to tourism, which they mention has affected their economy" (Perception of socio-environmental impacts, June 11,

2022). In this regard, the Bira company has "El Sexmo" mine that was mined during colonial times, which attracts domestic and foreign tourists because the mine now serves as a tourist attraction and allows visitors to tour it free of charge and with a guide service.

### Figure 20

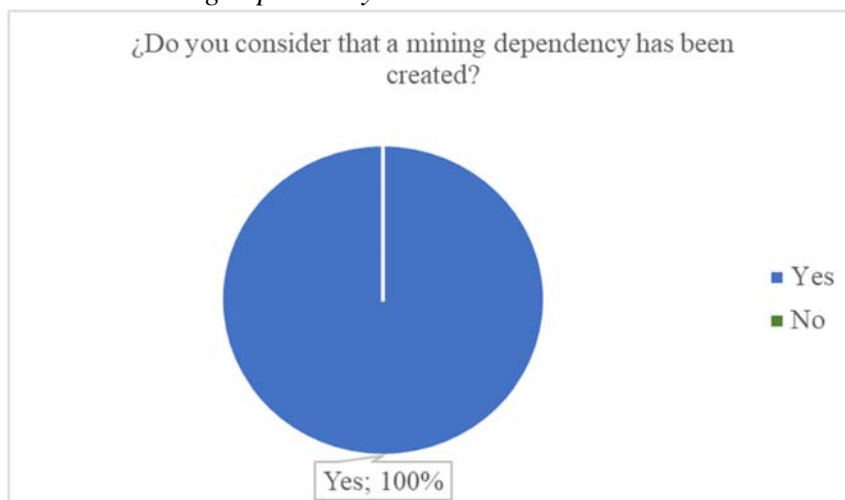
*¿Do you consider mining to be a good source of job creation?*



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 21

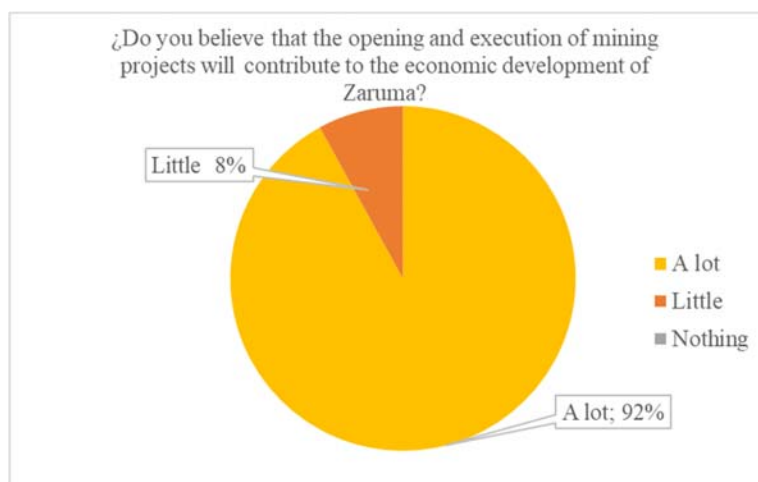
*¿Do you consider that a mining dependency has been created?*



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 22

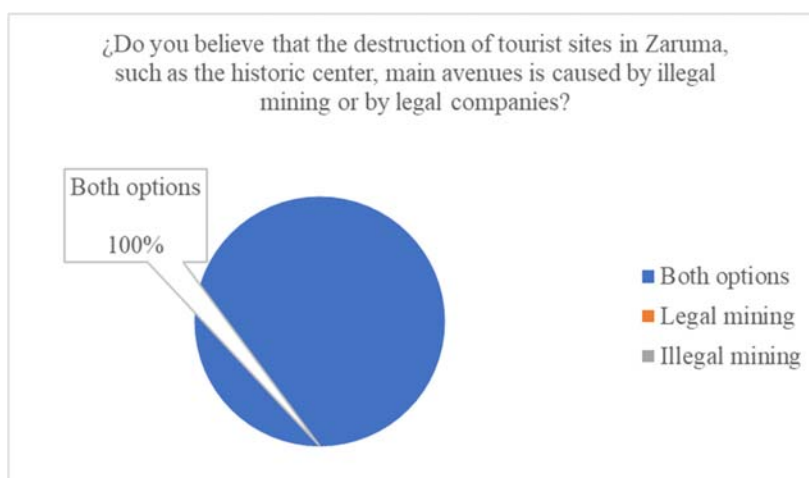
*¿Do you believe that the opening and execution of mining projects will contribute to the economic development of Zaruma?*



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 23

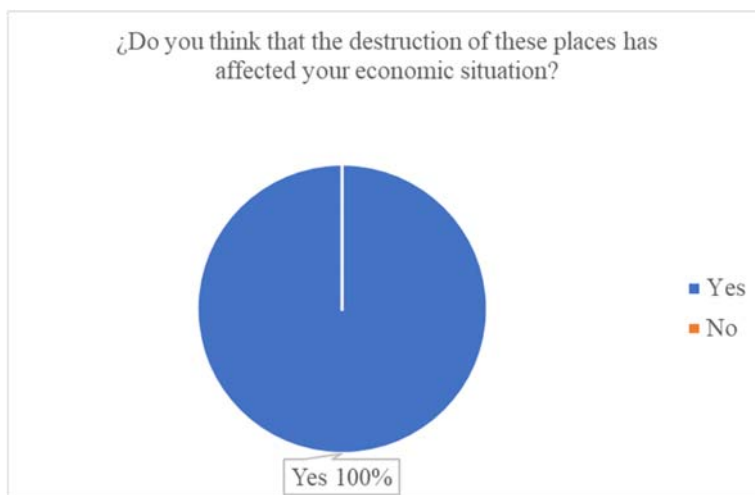
¿Do you believe that the destruction of tourist sites in Zaruma, such as the historic center, main avenues is caused by illegal mining or by legal companies?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 24

¿Do you think that the destruction of these places has affected your economic situation?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Institutional Aspect

Regarding the institutional aspect, the people surveyed consider that the Bira mining company has carried out its operations in the center of Zaruma, due to the lack of control and attention from the Municipal Government regarding mining exploitation, since according to the residents, they do not adopt public policies that contribute to sustainable economic growth, which are concerned about conserving the natural resources of the area, as evidenced in (Figure 24), (Figure 25), (Figure 26), (Figure 27).

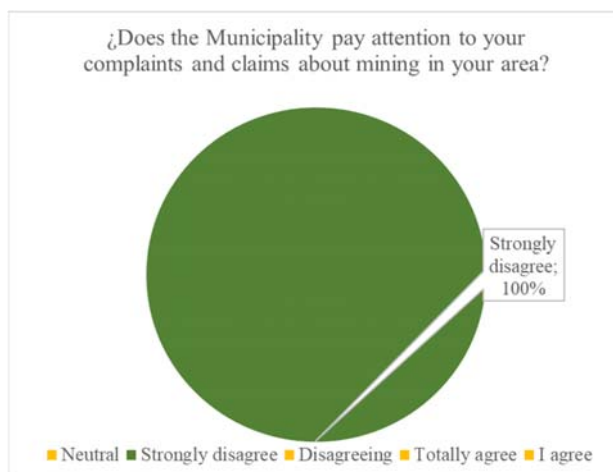
And against this backdrop interviewee number 1 considers that:

*Yes, mining generates socio-environmental impacts, but if all the companies are currently working it is because they are complying with the established norms. As such, the municipal government and all municipal governments have the exclusive competence to oversee land use in the canton, but not in the interior of the mine; the most that a municipal government can do is to control land use, which we grant. If it is in a suitable zone according to the canton's land use plan. So land uses obviously have to comply with a series of requirements and processes in order to be granted, and they are renewed year after year depending on whether they comply with the regulations. Also, from what I understand, the municipal government also has an environmental department where they are in charge of regulating, despite the fact that there are control agencies that are the Mining Regulation and Control Agency, Mae, Senagua, all of these control agencies. (Personal communication, June 12, 2022).*

In other words, the interviewee mentions that there are control agencies that are in charge of regulating mining and that the GAD is only in charge of issuing land use permits. This effectively shows that the Cantonal Government does not work with a policy of prevention and much less with environmental precautions that contribute to sustainable economic growth, since it does not have technical personnel for efficient environmental management, since it only considers that MAATE and other control entities should be in charge of these environmental problems generated by mining, leaving aside the socio-environmental impacts.

### Figure 25

¿Does the Municipality pay attention to your complaints and claims about mining in your area?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 26

¿Do you believe that the Bira Mining Company has carried out its operations in the center of Zaruma?



Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 27

¿Do you believe that the Municipality of Zaruma adopts public policies that contribute to sustainable economic growth?

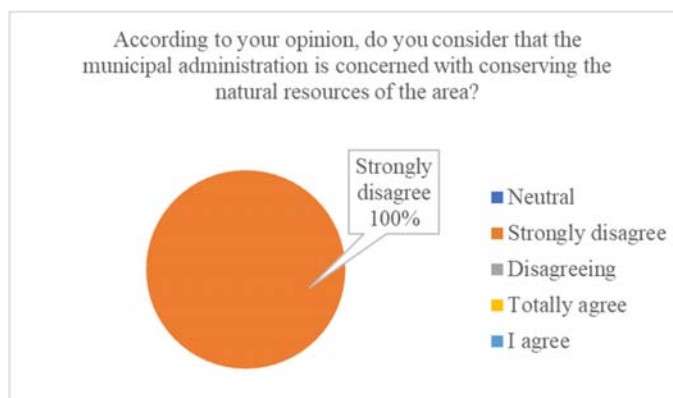




Source: (Perception of socio-environmental impacts, June 11, 2022).

### Figure 28

*According to your opinion, do you consider that the municipal administration is concerned with conserving the natural resources of the area?*



Source: (Perception of socio-environmental impacts, June 11, 2022).

## Discussion

In summary, based on the results obtained and the empirical evidence, particularly from the surveys and interviews provided in this study, the following perceptions have been identified.

Regarding the environmental aspect, the people surveyed do not agree with working in the area near where the Bira mining company is located, as they consider that they mainly prioritize the socioeconomic benefits over the environmental impacts that could be generated due to its location. In other words, this is a repeating pattern that has created many socio-environmental conflicts because mining projects prioritize economic benefits, which is a factor in the generation and evolution of other conflicts (Arellano, 2012). Inhabitants believe that mining cannot be entirely responsible because they are depleting natural resources, without protecting the soil, water and air, while exploiting minerals. In addition, the inhabitants of this area believe that these impacts have been generated by illegal and legal mining in the area, which has caused the following environmental impacts, such as sinkholes, which damage the visual landscape; biodiversity extinction due to the noise produced by the machinery and cars that move the material; exploitation of resources; water scarcity; and the appearance of mining waste, which is not disposed of in appropriate places, but rather goes directly into the water, damaging water resources. According to a study by Renaud (2009), when mining activities are carried out, the most affected natural resource is water, because the companies do not use proper water treatment. In addition, it was evident that the municipal administration is not concerned about the conservation of natural resources, since the GAD has the exclusive responsibility to monitor land use in the canton, but not inside the mine, i.e., the first interviewee mentions that there are control agencies that are responsible for regulating mining and that as GAD they are only in charge of granting permits for the land. It is evident that the cantonal government does not work with a policy of prevention and much less with environmental precaution, since it does not have technical personnel for efficient environmental management since it only considers that the MAATE and other control entities should be in charge of these environmental problems generated by mining.

Regarding the social aspect, respondents believe that the Bira mining company and other companies have affected their integrity due to the lack of regulation by municipal entities. They also state that mining has affected the health of family members and close people generating health problems and deaths, since mining, according to the ILO

(2018), is too dangerous an occupation that generates health impacts such as respiratory problems, severe headaches, hearing impairment, vision impairment, in addition to different risks related to landslides and injuries. Therefore, it is evident that mining is a very risky activity. However, according to the interviewee's perception and criteria, it generates approximately 70% of sources of employment.

In the same sense, in the economic aspect, respondents and interviewees mention that there is indeed a dependence on mining of 100%, and even more so due to the destruction of tourist sites such as the center and main avenues, which has generated negative effects on the community that was dedicated to tourism, since this terrible economic impact according to the respondents was given by legal and illegal companies, since so far no one has been found responsible for the sinkholes in the center of Zaruma, and 36% believe that the Bira mining company was also working in that sector, something that, according to the inhabitants, cannot be proven because they should enter the mines in the city, which they consider a risky task that no one wants to do, since the government has not given it the importance it deserves, and so they have not found anyone responsible for the socio-environmental impacts generated, which have affected and endangered many people. Regarding the institutional aspect, the respondents mentioned that they are unaware of the existence of public policies that contribute to sustainable economic growth, due to the lack of concern of the GAD, something that is detrimental to the residents since the institutional dimension should play an important operational role, so that the mining sector meets the objectives of environmental protection and conservation and demanding environmental and social regulations for mining activities (Almeida et al., 2021).

In addition, they comment that sustainable development cannot be given due to its pollution, since the "Industries that pollute the most are textile, agriculture and livestock and mining." (Acosta, 2018) However, because there are no alternatives that are viable to eliminate mining, a concept of sustainable mining has been proposed, which is taken as a reference as economic and social development, essential for many countries, due to the significant economic contribution generated by this activity (Ríos, 2018). With that context, the socio-environmental impacts described above show that in terms of the SDG 2030, they are not met since goal 8 Decent work and economic growth is not guaranteed because mining is a dangerous job and its exploitation has left behind impacts such as health problems, loss of natural resources, loss of biodiversity, and sinkholes which have affected tourism in the area, causing dependence on mining (UN, 2016).

In conclusion, there is no work with quality jobs, which stimulate the economy without damaging the environment. Another objective that is not guaranteed in the area is clean water and sanitation because, according to data from the respondents, there is water scarcity, damage to water resources and there is little concern from the GAD to combat these impacts (UN, 2016). And finally, Goal 11 sustainable cities and communities is not achieved, since in the area there are no public policies that provide the community with sustainable economic growth, allowing prosperity, pollution reduction and access to basic services, such as water (UN, 2016).

## Conclusion

The environmental crisis has affected nature due to the irresponsible interaction of man, affecting in a general way the life of the ecosystems that form the planet, and preventing nature from reproducing and regenerating itself at the same rate as the alterations. In the Ecuadorian context, extractivism plays a role because it has been established over time as a development model, thus becoming a fundamental pillar for the country's economy, causing the government to see extractive activities as strategic sectors to improve the "development of the country". Large-scale mining has made evident the socio-environmental impacts it generates, since the supposed economic contributions are not favorable and sufficient, since the environmental and social costs and damages generated by the extractive activity are more than an economic benefit (CEDHU & FIDH, 2010).

In this context, the results on the perception of socio-environmental impacts made by the residents show: Health problems, loss of biodiversity, precarious work, dependence on mining activity, lack of public policies and concern for the environment of the area, unsustainable development, affectation of water resources, loss of jobs in the tourism sector, among others. This demonstrates that mining is not compatible with the concept of development that

has been expressed by the governments of the time, since development must satisfy the needs of the present and future generations, but because mining is a non-renewable resource, it has an uncertain present and future.

As for Zaruma, according to the perception of the residents, it is evident that the community has suffered many socio-environmental impacts from the Bira mining company and other legal and illegal companies in the city, which have generated economic problems due to dependence on this activity, and have caused sinkholes that have harmed people who make a living from tourism. As for the social issue, it is evident that there is no decent work for mine workers, as they are in constant danger while performing extractive activities, due to the handling of explosives and chemicals that affect their health and can cause their death.

With regard to the environmental issue, it was evident that the GAD and Bira are not taking care of the environment because they are in the city and close to a lot of vegetation, and the noise of their machinery and cars that carry the material has affected biodiversity in the area. With these results, it is clear that there should be more participation of the canton's authorities and more than anything else, environmental management in the canton of Zaruma should be improved, since there is a lack of knowledge about the subject and more than anything else, a lack of concern and consideration for the environment in Zaruma, so they should generate projects and programs in coordination with different levels of government, competent in environmental issues, so that the Zaruma community can develop in a better way, promoting responsible administrations with the environment and natural resources. In addition, proposals and sustainability indicators should be developed for the mining sector in the area, in order to contribute to their adoption, and to reveal the challenges that exist in the mining area in economic, social and environmental areas.

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## APPENDIX A

### SURVEY ON SOCIO-ENVIRONMENTAL IMPACTS

"Socio-environmental impacts generated by the Bira mining company in the canton of Zaruma, in the period 2017 -2021" Perception of the socio-environmental impacts generated by the mining of gold, generated by the company Minera Bira.

1. Sex:

- Female  
 Male

Other:

2. Age:

3. Occupation:

4. Level of instruction:

Primary: Secondary:

Third level: Fourth level:

5. What are the main activities for the economic development of your area?

- Mining

- Agriculture
- Animal husbandry
- Commerce
- Tourism
- Another, which one?

6. Do you agree with the mining activity in this sector?

- Yes
- No

7. Do you think that mining is an activity that generates sustainable development for the community?

- Yes
- No

8. According to you, can responsible mining exist?

- Yes
- No

9. What is responsible mining for you?

- Water protection
- Soil protection
- Air protection
- Economic development
- Better social conditions
- Other

### **Environmental Impacts**

10. Do you think that environmental pollution from mining consists of the following?

- Affectation and reduction of non-renewable natural resources.
- Presence of toxic substances.
- Loss of biodiversity
- All
- Others, which ones? \_\_\_\_\_

11. Do you believe that environmental pollution in Zaruma is a consequence of illegal mining or legally established companies?

- Legal company



- Illegal mining
- Both options

12. Do you think mining has an impact on water resources?

- I agree
- Totally agree
- Disagreeing
- Strongly disagree
- Neutral

13. Have you evidenced the accumulation of mining waste in the vicinity of the Bira company?

- Yes
- No

14. What do you think is the final destination of the waste or residues resulting from mining?

- Secluded places
- Suitable establishments
- Other:

15. According to your opinion, what is the main problem that the environment has in your area due to mining?

- Extinction of fauna
- Exploitation of resources
- Damage to the visual landscape
- Massive deforestation
- Loss of biodiversity
- Sinkholes
- All
- Others, which ones? \_\_\_\_\_

16. In your opinion, do you consider that the municipal administration is concerned with conserving the natural resources of the area?

- I agree
- Totally agree
- Disagreeing
- Strongly disagree
- Neutral

**Social impacts**

17. Do you think mining has affected your integrity?

- Yes
- No

18. Do you think mining has affected your health?

- Yes
- No

19. Have any family members or acquaintances had health problems? or have you died due to contamination from gold mining?

- Yes
- No

20. Do you know if the inhabitants of your Canton have had health problems associated with mining?

- Yes
- No

21. What health problems?

- Breathing problems
- Severe headaches
- Hearing impairment
- Impaired vision

22. Do you think there has been a shortage of water over the years?

- Yes
- No

23. Does the Mayor's Office pay attention to your complaints and claims about mining in your area?

- I agree
- Totally agree
- Disagreeing
- Strongly disagree
- Neutral

**Economic impacts**

24. Do you consider mining to be a good source of job creation?

- Yes
- No

25. Do you think that a dependency on mining has been created?

- Yes
- No

26. Do you think that the opening and execution of mining projects will contribute to the economic development of Zaruma?

- Nothing
- Little
- A lot

27. Do you believe that the destruction of Zaruma tourist sites, such as the historic center, main avenues is caused by illegal mining or by legal companies?

- Illegal mining
  
- Legal Mining
- Both options

28. Do you think the destruction of these places has affected your economic situation?

- Yes
- No

29. Do you believe that the Bira Mining Company has carried out its operations in the center of Zaruma?

- Yes
- No

30. Do you believe that the Municipality of Zaruma adopts public policies that contribute to sustainable economic growth?

- Yes
- No
- Unknown

## APPENDIX B

### INTERVIEW ON PERCEPTION OF SOCIO-ENVIRONMENTAL IMPACTS

#### **"Socio-environmental impacts generated by the bira mining company in the canton of Zaruma, in the period 2017 -2021"**

##### **Synopsis**

This Degree Work is carried out by Patricia Alvarado Arce, student of the International Studies career of the University of Azuay and directed by the lawyer Ana María Bustos Cordero.

The general objective of this work is to determine the main socio-environmental impacts that the bira mining company has generated in the canton of Zaruma, in the period 2017-2021. The person interviewed individually is expected to provide his opinion on the issue of the impact that mining generates in the social, economic and environmental sphere.

Excerpts from the interview could be cited in the Degree Paper. The information will not be used in any other way.

##### **Questionnaire**

##### **Interview N°1**

##### **Municipal GAD of Zaruma**

#### **1. What is your opinion on the socio-environmental impacts that have been generated by mining?**

Yes, mining generates socio-environmental impacts, but if all companies are currently working, it is because they are complying with the established standards. As such, the municipal GAD and all the municipal GADs, have exclusively the competence to ensure the use of land in the canton, but not in what is the interior mine, the maximum that a municipal GAD can reach is in the issue of control of land uses, which we grant. If it is in a suitable area according to the territorial planning plan of the canton. Then the land uses, because obviously they have to meet a series of requirements and processes to be granted and it is renewed year by year depending on whether they comply with the regulations. Both in what the land management law says, and the local ordinance laws, no. Also from what I understand the municipal GAD also has an environmental department where they are responsible for regulating, although there are control bodies that are clearly the Mining Regulation and Control Agency, Mae, Senagua, all these control bodies. As for, if it is a good generator of employment, in my opinion it is very personal. Mining is a dangerous job, but it is related, at least I believe in 70% of the sources of employment either direct or indirect because it has been seen that when mining is booming, the economy even of the smallest store is energized instead, when we do not have mining, I think we

are all affected, whether we are miners or not, so I think it is something by idiosyncrasy itself that we depend almost 100% on mining.

**2. Do you consider this phenomenon to be just an environmental problem?**

No. Well, if we take it into account as the problem of this, mining generates environmental and social impacts, and a diversity of problems that it triggers, just as it is a problem, it also generates development, right? So I believe that a mining carried out with all the rules provided by the control entities, I think. Would it be ideal, wouldn't it? So you have to fight to get to that.

**3. What is the Municipal GAD of Zaruma doing to contribute to the fight against the socio-environmental impacts that mining generates?**

As such the municipal GAD and all municipal GADs. They have exclusively the competence to ensure the use of land in the canton, but not in what is the interior mine no, the maximum that a municipal GAD can reach is in the issue of control of land uses, which we grant. If it is in a suitable area according to the territorial planning plan of the canton. Then the land uses, because obviously they have to meet a series of requirements and processes to be granted and it is renewed year by year depending on whether they comply with the regulations. Both in what the land management law says, and the local ordinance laws, no. Also from what I understand the municipal GAD also has an environmental department where they are responsible for regulating, although there are control bodies that are clearly the Mining Regulation and Control Agency, Mae, Senagua, all these control bodies.

**4. Do you know if the inhabitants of your canton have had health problems associated with gold mining?**

Well directly, that they are related to mining more, we have what are mining accidents, no, that well, that already responds to labor safety. Once good, very personal criteria. I heard that some mercury had been in the body of a person who was not even a miner. However, this as being raised to high temperatures, becomes a heavy metal gas. And, because it has repercussions on health. But I think that in the long run it could happen if it is not handled very well, which is the gaseous and liquid waste that is poured into nature.

**Interview N°2**

**Bira Company**

**1. What kind of mining do they develop?**

The mining we mainly develop is gold, silver and copper.

**2. Do you have a permit to carry out mining activities?**

If we have all the corresponding permits for our operations on a national scale, since we pay royalties and are constantly visited by the environment, that is why we have environmental licenses for the exploitation of the mining areas and the benefit plant.

**3. What kind of technique is used for gold mining?**

The techniques we use are cutting and filling, that is, tunnels are made and at the same time the remaining spaces are filled in order to be held, and avoid either the movement and fall of rocks and facilitate the recovery of pillars.

**4. Is the wastewater in the extraction process subjected to any treatment process prior to its discharge into the environment?**

We do daily monitoring of the water that comes out inside the mine, that is, we have a decantation plant where it is processed and treated so that the water comes out much cleaner than what comes out in the mine, since it is very acidic, so the water is pumped and goes out to a decantation pool, where it is treated, and apart the solids are recovered, which allows the water at the top to be relatively free of contaminants and allows the water to follow its course to the ravine without any environmental damage. And as soon as mitigating socio-environmental impacts we adopt many actions, one for example is to give talks to our miners and different mining companies, to carry out an adequate mining, an adequate handling of explosives to avoid accidents etc. So we focus more on the part of how to mitigate socio-environmental impacts and make responsible mining that avoids any type of impact on the community and the environment.

**5. What actions do you take to prevent health and safety impacts to your workers and the community?**

We have a high safety system, the worker from the moment he enters must go through interview and medical processes to know if he is fit to work, for example, in the case of an elderly person, he can no longer enter the mine, but he can perform other work suitable for his well-being. In addition, we have helmets, glasses with special meshes so that the stones do not enter them while drilling, so in every way we have all the equipment depending on the activity that the worker performs, instruments that we obviously provide them in the company.

**6. What actions do you take to prevent deforestation, damage to the visual landscape, and loss of biodiversity in the area?**

In this case from the beginning we have been concerned about this issue is for that reason we have reforested more than 70 hectares of trees which has helped to maintain an adequate visual landscape and without much loss of biodiversity

**7. What actions do you take with mining waste?**

They have their storage first, and then take it to an environmental manager, many times they buy us by weight to recycle. That is, all our waste will go through proper processes to prevent contamination.

**8. How does the company prevent environmental pollution?**

We prevent it by encouraging that you can carry out a responsible mining with the environment, it is for that reason that we have received several awards such as, the Environmental Excellence Award II Latin American Mining Agency Contest (Olami), Santiago de Chile in 2000, 2002, 2004, so we consider that it is an appropriate way to prevent, we also try to resort to all possible processes

to avoid any type of pollution such as treating water recycle, reforestation, taking care of our staff, giving talks, etc.

**9. What actions do you take to mitigate the socio-environmental impacts of mining?**

We adopt many actions one for example is to give talks to our miners and different mining companies, to carry out an adequate mining, an adequate handling of explosives to avoid accident etc so we focus more on the part of how to mitigate the socio-environmental impacts and make a responsible mining that avoids any type of impact on the community and the environment.