



PERSPECTIVE

SOCIAL IMPACT ASSESMENT

SEPTEMBER, 2023



**SIA
APPLICATION
IN CHILE**

**RELEVANCE
OF SIA**

CASE STUDY

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ABOUT GEM

We are an industrial engineering company whose focus is to support the mining industry in management and economics. We have six business areas, which encompass all our experience, while we develop the most advanced tools applied in mining. With more than 14 years of experience and more than 400 projects successfully implemented worldwide.



MISSION

We are a provider of industrial engineering products and services of excellence to the global mining industry. We seek to pave the way for the mining industry of the future, while maximizing the business value of our clients by improving their ability to make strategic decisions, through innovative services delivered effectively by a highly qualified professional team.

We have six business areas:



EDITORIAL

For the mining industry today it is important to understand that there is not only a direct impact on natural resources and the environment, but also an effect on communities and people's quality of life.

That is why mining companies often propose corporate social responsibility programs, compensation or the development of infrastructure to improve the living conditions of a community. However, this social impact is sometimes not reflected in the private evaluations of the companies (determination of the Net Present Value or NPV), ignoring the social value (jobs, local economy, induced income, among others) that the exploitation of a deposit could have in a given area.

The social impact of a project through the Social Impact Assessment study complements the environmental and economic studies by systematically and holistically examining the social aspects of the implementation of mining projects.

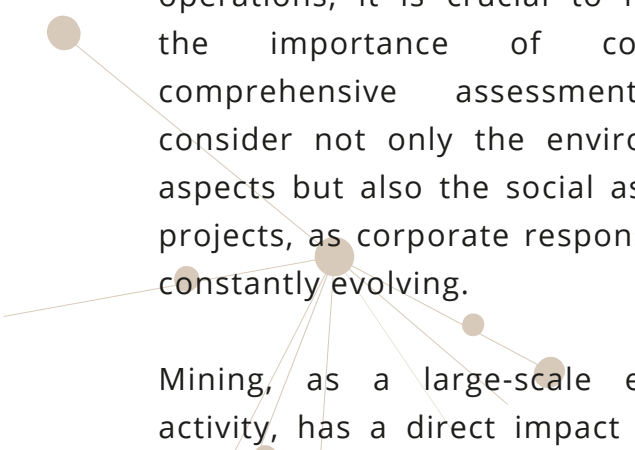


Isaac Paredes
Chief Operating Officer

It is a tool that allows a comprehensive understanding of the effects (both positive and negative) that an industry generates on society.

In GEM's opinion, the Social Impact Assessment is a relevant and necessary instrument for the mining industry, which is constantly evolving in terms of corporate responsibility.

INTRODUCTION



Social Impact Assessment (SIA) is an essential tool to comprehensively understand and address the effects, both positive and negative, that an industry generates on society. In a context where companies need to obtain the so-called "social license" (Wilson et al., 2022) to carry out their operations, it is crucial to recognize the importance of conducting comprehensive assessments that consider not only the environmental aspects but also the social aspects of projects, as corporate responsibility is constantly evolving.

Mining, as a large-scale economic activity, has a direct impact not only on natural resources and the environment but also on local communities, the regional economy, and people's quality of life (Heydari et al., 2023). First and foremost, it's important to highlight that mining can create both benefits and challenges in the social realm. On the one hand, this industry can be a driver of economic development, generating employment, promoting investment, and contributing to the generation of tax revenues.

Additionally, mining companies often establish corporate social responsibility programs that seek to improve the living conditions of local communities by promoting education, health, and infrastructure development.

However, it cannot be ignored that mining also generates negative impacts if not carried out responsibly. Some examples of these impacts include the various adverse effects on communities, pollution from CO₂ emissions and waste generation (such as tailings), depletion of natural resources, and disruption of ecosystems. These challenges can lead to social conflicts, affect people's health and well-being, and consequently erode trust in the mining industry.

In this regard, Social Impact Assessment (SIA) emerges as a tool to address these challenges and quantify the benefits of mining for society. Currently, Environmental and Economic Impact Assessments are common practices in the mining industry. However, it is essential to acknowledge that these approaches are not sufficient to fully understand the effects of mining.

SOCIAL IMPACT ASSESMENT

Social Impact Assesment definition

Social Impact Assessment is a methodology that evaluates the social effects of projects or operations at the local, regional, or national level. Social Impact Assessment emerged in the United States in 1969 as a complementary methodology to Environmental Impact Assessment (EIA), taking into consideration the social effects of projects or operations.

Although both assessments share certain elements, it is important to differentiate that SIA specifically focuses on social impacts. The growing importance of SIA in mining is due to changes in the perception and valuation of local and national development, as well as the evolution of social concerns. This has led to changes in regulatory processes in both developed and developing countries.



SIA APPLICATION IN CHILE

While this section could refer to any country, Chile has been taken as a specific example for the exposition, given GEM's extensive experience in SIA in this country.

Regarding the implementation of Social Impact Assessment (SIA) in Chile, the entity responsible for regulating and establishing guidelines for Social Project Evaluations is the Ministerio de Desarrollo Social y Familia. According to the Ministerio de Desarrollo Social y Familia, the social evaluation of projects must consider the following fundamental elements: firstly, a comprehensive identification of the problem is required, highlighting the social variables that could be positively or negatively affected as a result of the situation with or without the project.

Next, it is necessary to conduct a diagnosis of the baseline situation, i.e., the current situation in the absence of the project.

The purpose of this diagnosis is to describe and analyze the main aspects related to the initial situation of the project.

This includes identifying the study area, i.e., the geographical area where the project takes place, and the area of influence, which covers the boundaries within which the project could have an impact. Additionally, it is essential to identify the target population and quantify the social variables of interest in the initial situation (Ministerio de Desarrollo Social y Familia, 2013).

The social evaluation of the project is a fundamental step that would help complement its implementation. For this purpose, it is necessary to identify and quantify the costs and benefits associated with the project. It is essential to assess these costs and benefits and determine the net benefit flows and social profitability indicators, such as Net Present Value (NPV) and social Internal Rate of Return (IRR).



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It is relevant to note that there are various models and methodologies for conducting a Social Impact Assessment, although an international standard has not yet been established.

However, previous studies available in the literature reveal common and similar elements to those mentioned earlier by the Ministerio de Desarrollo Social y Familia, which are essential in an SIA.



These elements include identifying interested and affected groups, analyzing impacted communities, identifying affected activities, forecasting direct and indirect effects of the project, as well as recommending mitigation measures that could include compensations.

On the other hand, it is essential not to confuse Social Impact Assessment (SIA) with the Social Evaluation of the project. The latter mainly focuses on comparing economic costs and benefits from a social perspective to make a judgment about the feasibility of the project.

While a Social Evaluation considers all direct costs and benefits (including externalities), it generally does not address non-monetary or indirect impacts on local communities, unlike Social Impact Assessment.



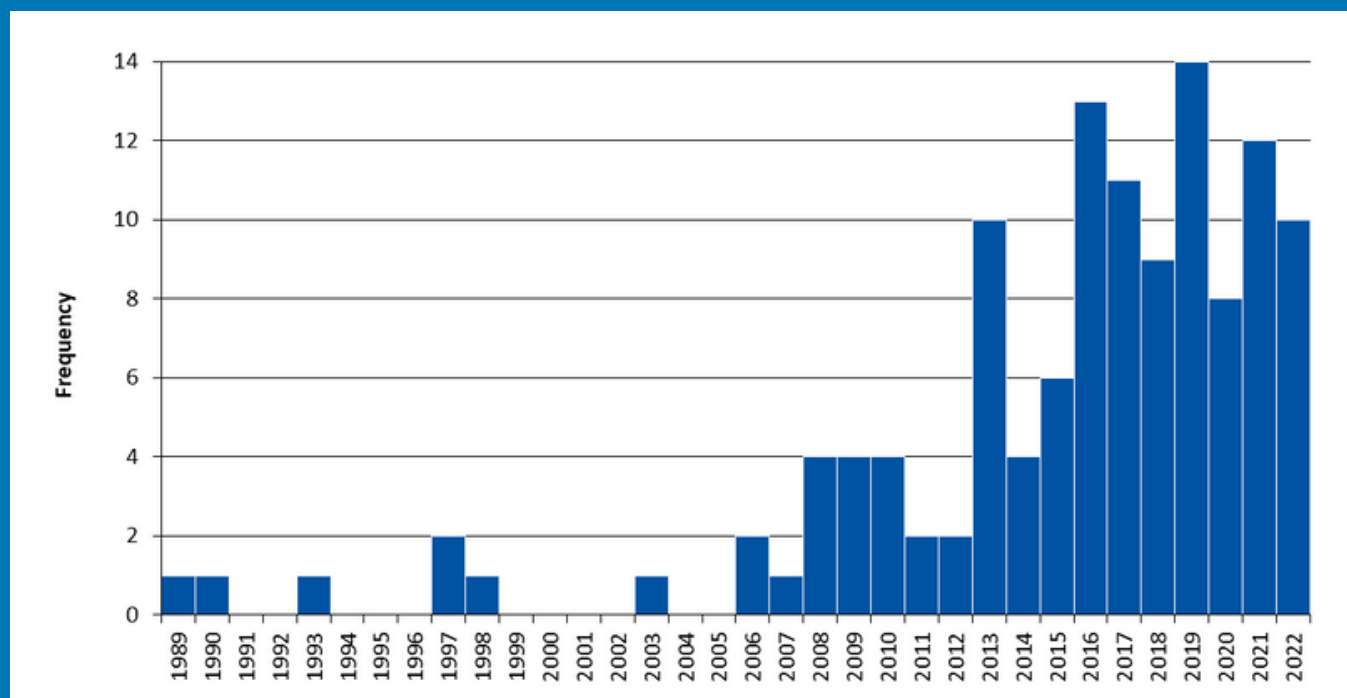
**SOCIAL IMPACT ASSESSMENT (SIA)
IS A METHODOLOGY FOR
REVIEWING THE SOCIAL IMPACTS
THAT PROJECTS OF ANY KIND,
PARTICULARLY MINING PROJECTS,
HAVE ON A LOCAL COMMUNITY,
REGION OR COUNTRY.**



APPLICATION OF SIA IN MINING

Over time, there has been a steady increase in the number of studies published in academic[1] journals evaluating social impact, as seen in **Figure 1**. This figure illustrates the evolution regarding the use of this type of assessment during the period 1989-2022, highlighting a significant increase in studies related to this methodology (SIA) starting from 2013. Moreover, approximately 91.9% of the reviewed studies in academic literature were concentrated in the period 2008-2022. While these results are based on the review of academic literature, it is reasonable to expect that the industry has behaved similarly by incorporating this type of assessment more frequently in mining projects. In fact, this has been precisely the practical experience of GEM in Chile.

FIGURE 1. INCREASE IN THE USE OF SOCIAL IMPACT ASSESSMENT METHODOLOGY IN MINING

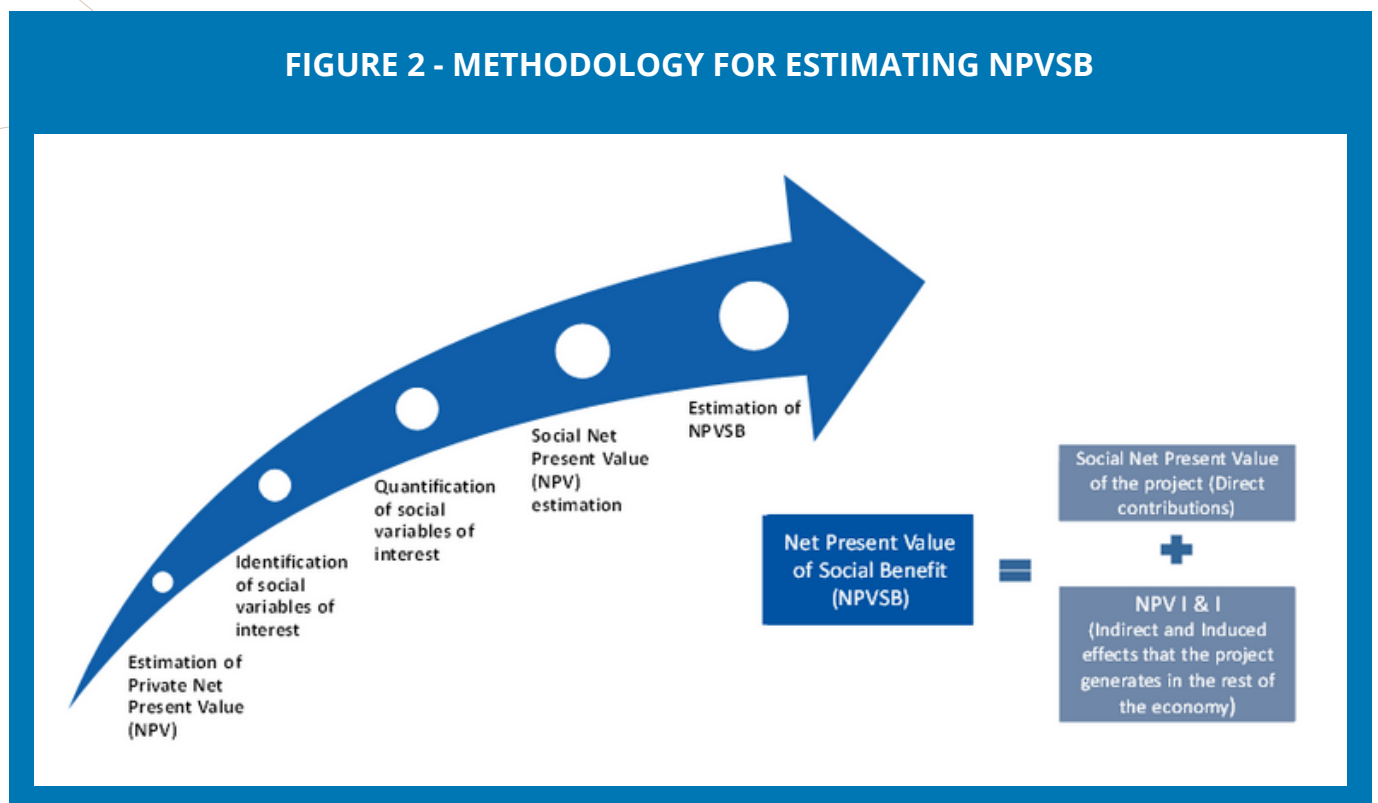


Source GEM: Own elaboration based on Scopus

ESTIMATION OF NET PRESENT VALUE OF SOCIAL BENEFIT (NPVSB)

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Firstly, the estimation of the Private Net Present Value (NPV) of the project is carried out by applying the discounted cash flow method, as shown in equation (1). The Private NPV corresponds to the sum of the discounted cash flows f_i using the private discount rate r_p for the periods $i=[0,n]$, where n is the evaluation horizon.



Source GEM: Own elaboration

$$NPV_{private} = \sum_{i=0}^n \frac{f_i}{(1 + r_p)^i}$$

This estimation takes into consideration factors such as prices, costs, production quantities, royalties, taxes, and investments. Subsequently, the identification of relevant social variables is carried out. Once all the variables have been identified, their quantification is performed. Following this, the same procedure is repeated to calculate the Social Net Present Value (NPV), but in this case, it corresponds to the sum of the discounted social cash flows $[f']_i$ using the social discount rate r_s , which considers additional social impacts and benefits. The calculation of the Social NPV is presented in equation (2).

$$NPV_{social} = \sum_{i=0}^n \frac{f'_i}{(1 + r_s)^i}$$

Next, the previously calculated Social NPV and Private NPV are added, also incorporating the indirect and induced effects that the project generates in the rest of the economy. This way, the Net Present Value of Social Benefit (NPVSB) is calculated using equation (3), which accurately reflects the net social benefits derived from the evaluated project.

$$NPVSB = NPV_{social} + NPV_{indirect \text{ and } induced \text{ effects}}$$

It is important to highlight that to conduct the SIA, it is necessary to have the input from the economic evaluation of the project in question. In the economic evaluation, there is key information to build the SIA, such as operational costs, realized investments, and the NPV of the project, among others.

Ultimately, this comprehensive and rigorous process enables a holistic assessment of the social impact and provides a solid foundation for making informed decisions in the realm of projects.

Relevant social variables according to the literature

Table 1 shows a list of the main social variables that are most frequently found in studies of this nature, such as Gross Domestic Product (GDP), wage multiplier, poverty situation, fiscal revenue, exchange rate, among other significant variables that allow for the calculation of the Net Present Value of Social Benefit (NPVSB). A study conducted by Heydari et al. (2023) mentions a large part of these variables.

TABLE 1. SOCIAL VARIABLES FOR QUANTIFICATION OF NVPSB

VARIABLE	DEFINITION
Gross Domestic Product (GDP)	Most studies present estimates of the "multiplier" effect that mining activity has on GDP, both at the regional and national levels
Employment	The impact of mining in terms of indirect and induced jobs generated by each direct worker hired is described, as well as the "multiplier" effect of the remuneration of indirect and induced workers
Poverty status	According to the literature, there is consensus that mining has had a positive and significant impact on poverty reduction, especially in the regions where mining activities are carried out
Tax collection	Some studies present estimates related to taxes, royalties, and surpluses paid, which contribute significantly to the government's financing of social programs
Income distribution	It should be noted that in mining regions there is generally less inequality in terms of Gini coefficient compared to non-mining regions
Innovation	Some studies mention the additional positive impact of mining in terms of innovation, such as collaboration with universities for research and development of patents
Negative health effects	Most studies indicate negative impacts on the health of the population near smelting centers and those working in subway mines with poor ventilation conditions
Exchange rate	It is recognized that the price of minerals and the phenomenon known as "Dutch disease" have an impact on the determination of the exchange rate between the CLP and the US\$, which may negatively affect other exporting sectors
Infrastructure	Mining is generally associated with remote geographic areas, which leads mining companies to develop educational, hospital, and road infrastructure, among others. This benefits direct, indirect and induced employees as well as local communities
CO ₂ generation	Several studies indicate that environmental pollution is one of the main negative externalities of mining. In the specific case of Chile, a negative impact on CO ₂ generation is recognized
Human Development Index and safety	It has been empirically observed that in general, mining regions have higher human development and safety indices compared to non-mining regions
Life cost	The high salaries and bonuses in mining (compared to other productive sectors) generally produce inflation in the areas where this activity is developed, which generates negative effects on the local population (higher cost of living)

Source GEM: Own elaboration



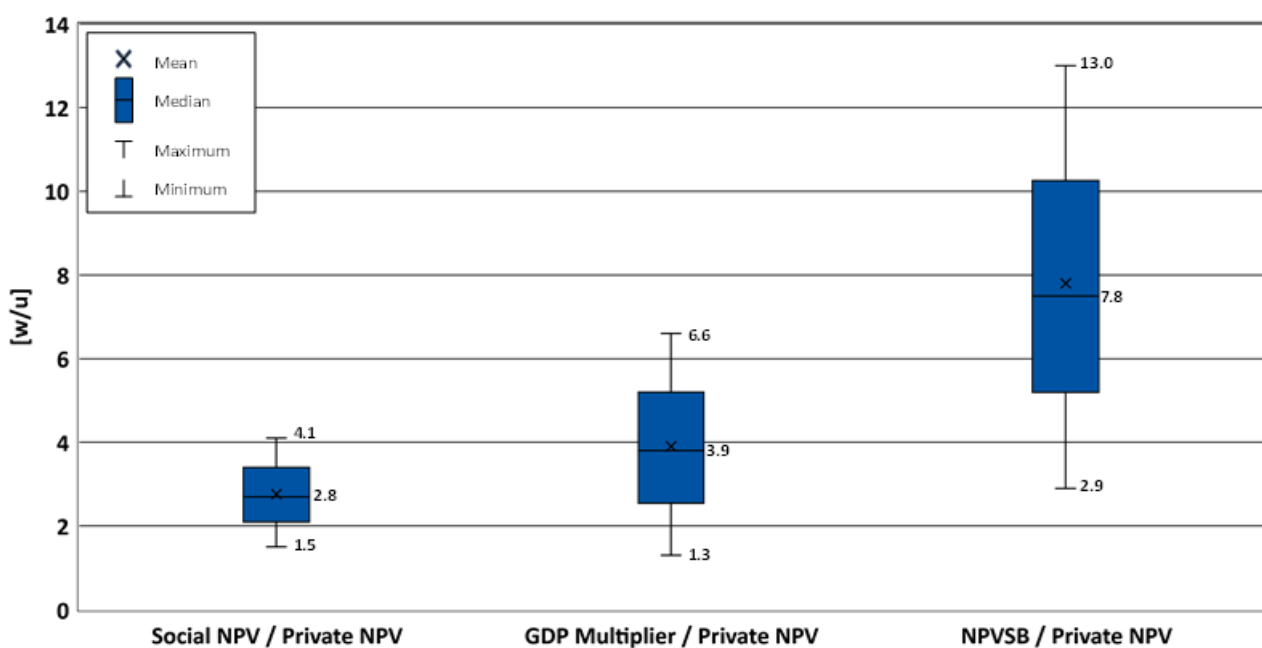
RELEVANCE OF SIA

In **Figure 3**, a box plot with statistics of the ratio of social variables to Private NPV for different projects[1] is shown. These statistics correspond to Social Impact Assessment studies conducted by GEM in the copper and lithium industries in Chile.

On average, it is observed that the Social NPV and the GDP Multiplier exceed the Private NPV by approximately 2.8 and 3.9 times, respectively. These figures primarily indicate that society obtains and perceives significant benefits from private projects. This is achieved through fiscal revenue, supply chain linkages, and job creation, among other factors.

Furthermore, it is observed that the value corresponding to the NPVSB (Net Present Value of Social Benefit) is, on average, 7.8 times greater than the Private NPV, and typically fluctuates in a range between 2.9 to 13 times the value of the Private NPV. This means that for every dollar generated by a private project in the mining industry, the rest of society could benefit, on average, with the receipt of 6.8 dollars and in the best-case scenario, with up to 12 dollars.

FIGURE 3. BOX PLOT OF THE RATIO OF SOCIAL VARIABLES TO PRIVATE NPV



Source GEM: Own elaboration

CASE STUDY

GEM has extensive experience in mining projects and has conducted multiple **Social Impact Assessment** studies for copper and lithium projects and operations. Although Social Impact Assessment is not required by authorities in Chile, these studies have helped our clients to understand quantitatively the impact that mining projects have on communities and society as a whole.

In this section, a case study of a Social Impact Assessment for a copper mining project will be presented.

Project Context

This case study describes the work carried out by GEM to support the development of the Social Impact Assessment (SIA) for a copper mining project to complement the evaluation stages. The objective was to determine quantitatively and qualitatively the impact that this project would have on society, with a special focus on the commune, province, and region where it is located.

The identified and quantified variables are as follows:

1. Social discount rate: Represents the opportunity cost incurred by the country when using resources to finance social projects.

2. Fiscal revenue: Taxes paid by companies to the government.

3. Specific mining tax: Copper royalty.

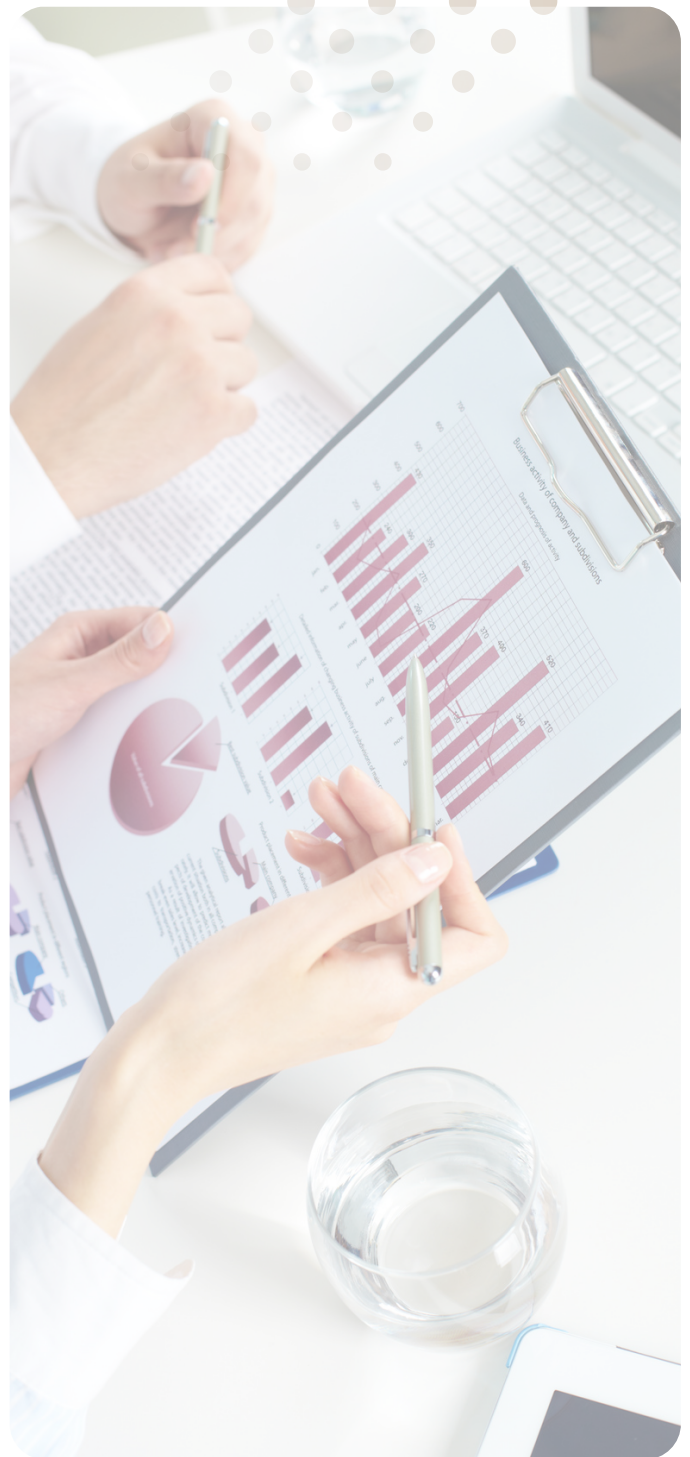
4. CO2 externality: Quantifying the impact generated decreases the social value due to the carbon footprint.

5. Social NPV: A metric that seeks to evaluate the social profitability of a project.

6. GDP multiplier: Indicates the effect of mining on other productive sectors through supply chain linkages.

7. Wage multiplier: Shows the effect of mining on job creation and wages in other sectors.

8. NPVSB (Net Present Value of Social Benefit): A metric that seeks to evaluate the social profitability of a project, considering the indirect and induced effects generated by supply chain linkages derived from mining activity.



RESULTS AND MAIN CONCLUSIONS

Figure 4 presents the breakdown of the NPVSB (Net Present Value of Social Benefit) by each social variable[1]. It can be observed that the Private NPV corresponds to 3,058 MUS\$, the Social NPV to 7,013 MUS\$, and the NPVSB to 15,312 MUS\$. The results show that the Social NPV is more than 2.3 times the Private NPV, while the NPVSB is 5 times the Private NPV, indicating that for every dollar generated for the project's shareholders, the rest of society receives 4 dollars.

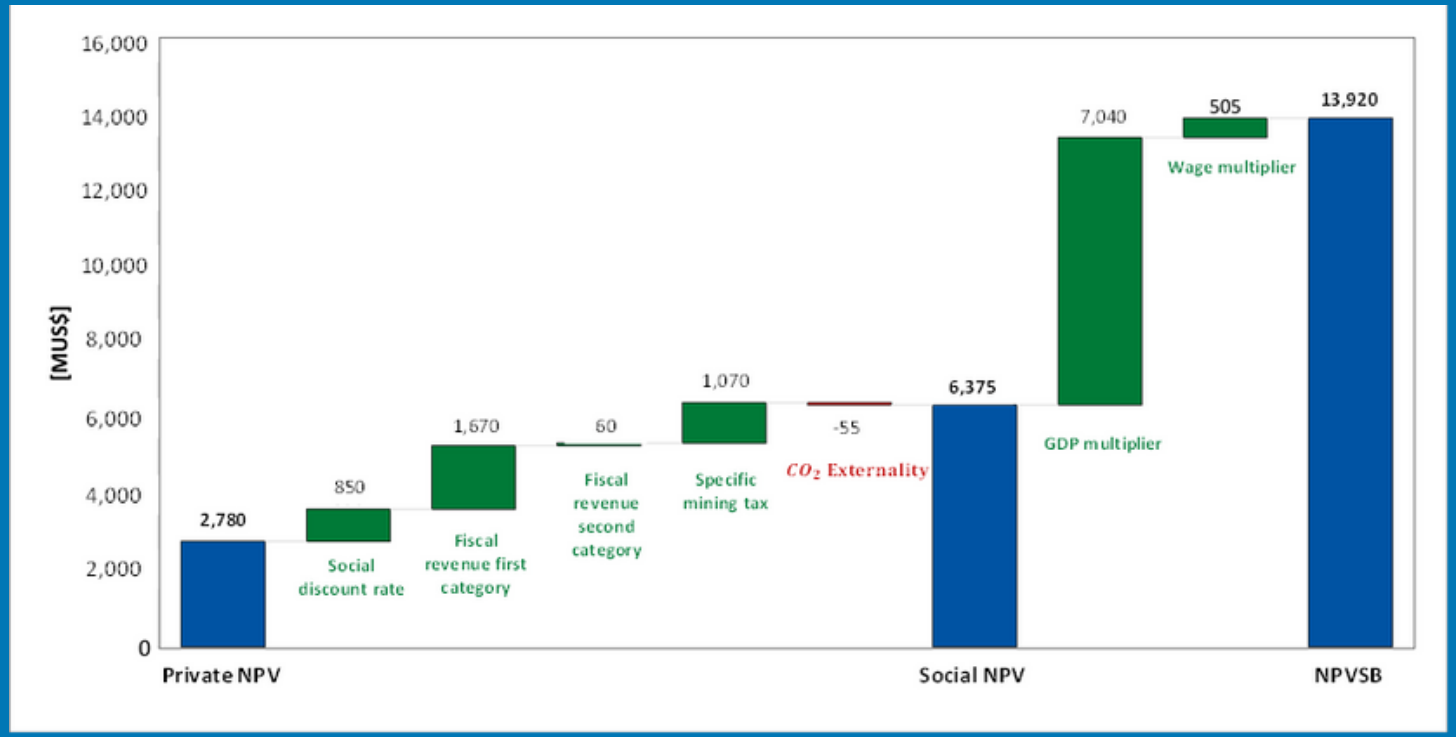
The GDP multiplier effect, representing supply chain linkages generated by the project, contributes a total of 7,744 MUS\$, which represents more than half of the NPVSB and demonstrates the positive impact on economic growth and regional development. Additionally, in terms of wages, the project would contribute 556 MUS\$ due to the wage multiplier effect. The metrics above translate into an average annual increase of 3.3% in the GDP of the region where the project is located.

[1] For confidentiality reasons, the resulting values from the actual evaluation were arbitrarily adjusted, but the magnitudes were preserved.

The contribution to the government's revenue would amount to 3,080 MUS\$, with 59.6% of this amount coming from first-category taxes, 38.2% from Specific Mining Tax, and 2.2% from second-category taxes. These fiscal revenues demonstrate the project's importance in terms of contributions to the country's development and financing.

It is also observed that the GDP multiplier variable (which represents supply chain linkages) contributes 50.4% to the NPVSB, mainly due to materialized investments. Other variables that contribute significantly are the social discount rate, the specific mining tax, and first-category fiscal revenue, contributing 6.1%, 7.7%, and 12.0%, respectively. Together, these variables contribute 76.2% of the NPVSB. On the other hand, it is observed that the CO₂ externality is limited, representing only 0.4% of the NPVSB.

FIGURE 4. DECOMPOSITION OF THE NPVSB OF THE PROJECT



Source GEM: Own elaboration

As demonstrated in this example, Social Impact Assessment (SIA) is a methodology that allows for the examination of the social impacts that projects of any kind, particularly mining projects, have on a local community, regional level, or country. As evidenced by the studies conducted by GEM, this knowledge is crucial for mining companies to effectively manage their social license to operate.



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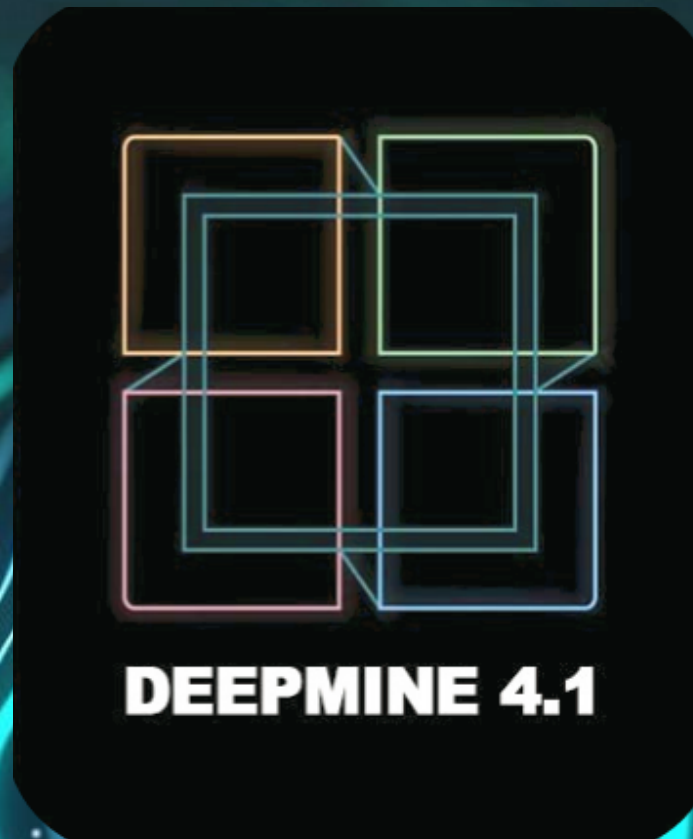
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