

**NEW FRONTIERS IN
PRODUCTIVE TRANSFORMATION
IN THE ANDEAN REGION**

THE EXTRACTIVE SECTOR

**AS A LEVER FOR PRODUCTIVE
TRANSFORMATION**



GROWTH AND PRODUCTIVE
TRANSFORMATION AGENDA



THE EXTRACTIVE SECTOR

**AS A LEVER FOR PRODUCTIVE
TRANSFORMATION**

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CREDITS

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FOREWORD

In our first publication in this series on growth and productive transformation, we emphasized that the Andean Region is at a crucial moment for sound decision-making. Since the Paris Agreement, the world has embarked on a decarbonization agenda; there may be challenges in its implementation, but the world has decided to move in this direction. The Andean Region faces great challenges, but also has enormous potential for opportunities.

In addition to this reality, there are the consequences of the COVID-19 pandemic. Beyond the high costs in terms of loss of human life and economic activity, the pandemic has had a structural impact on the region. All of these challenges come at a particular time. After growing at an average of 4.2% between 2000 and 2014, growth has slowed in the Andean Region. The long-term growth forecast is 2.9%, according to the International Monetary Fund.

In this context, the extractive industries sector is at the center of the transition. The Paris Agreement sets out commitments for countries to mitigate global warming and its effects. This agreement is generating meaningful changes in the global energy structure. Consequently, fossil energy sources are losing ground to nontraditional renewable energies. However, as a result of this agreement, demand for metals and minerals is expected to increase in the coming decades.

The extractive industries sector has historically played a significant role in the Andean Region. Mining activity dates back to colonial times in the region and oil and gas production to the early 20th century. In this context, the role of the sector in economic and social development is of vital importance. This situation presents two realities. On the one hand, there will be geographical areas that will face a negative impact (due to a reduction in the demand for hydrocarbons and coal), and on the other hand others will face positive effects (due to an increase in the demand for minerals for the transition). Added to this scenario are new demands in terms of environmental, social, and governance policies in the sector, which are emerging from both the international community and civil society.

The historical experience of the region shows that, despite having abundant natural resources and enormous potential, these countries have not been able to take full advantage of the opportunities that these resources offer. Although major progress has been made, there are still challenges in the management of environmental impacts. Additionally, there are high levels of conflict related to extractive projects that have to do with challenges related to governance and transparency in the sector. On the other hand, the lack of consistency in public policies has limited the capacity to generate and take advantage of adequate productive chains around them. Finally, in the current context, it is clear a challenge exists regarding implementing and taking advantage of disruptive technologies in the sector with the aim of making the energy transition a reality.

However, as international experience proves, these challenges can be overcome. To do so, it is essential to encourage the forging of shared visions and mutual benefit agreements that contribute to mitigating conflicts and promote sustainable economic and social development. This implies avoiding or minimizing environmental impacts and having appropriate regulation for the sector. In addition, it will be necessary to improve fiscal management and promote transparency. Finally, it is essential to seek and encourage the development of effective productive chains to promote sustainable and equitable economic development.

This publication of the Andean Group Department of the Inter-American Development Bank (IDB) seeks to contribute ideas for this reflection. This work is not intended to be an in-depth study of how the transition should be approached. The IDB has been making some recommendations on public policy decisions that the sector could adopt. Likewise, some think tanks in the region have been making proposals on these opportunities for transformation. Therefore, this research aims to complement and contribute to those proposals.

This publication analyzes areas that, according to evidence, can influence the performance of the sector by identifying gaps. The aim is to make a proposal to generate opportunities in the sector. Thus, issues such as social license, institutions, and the integration of the sector into the productive systems of the countries are addressed.

Likewise, emphasis is placed on the role that digitalization can play in the extractive sector and how it can contribute to energy transition. Finally, having a productive transition agenda implies setting out an employment agenda. However, it is essential that employment be inclusive; therefore, the issues of gender and inclusion of small producers are an essential component of this research.

We hope that this publication will be a source for dialogue on the role of the extractive sector in the productive transition and that it will complement the Bank's action in assisting our borrowing member countries and collaborating with them to achieve this common goal.

MIGUEL CORONADO

Acting Interim General Manager
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1. INTRODUCTION

A SECTOR AT THE HEART OF THE TRANSITION

1.1 An important sector for the region

Historically, the extractive industries sector has played a significant role in the Andean Region. Mining activity dates back to colonial times in the region, and petroleum activity began in the early 20th century. More recently, in the last decade revenues derived from natural resources represented, on average, 8.2% of the regional GDP.¹ Furthermore, extractive industries make up a high percentage of total exports in the countries of this region. In 2019, these² accounted for 65.79% of exports in Bolivia, 50.34% in Colombia, 40.09% in Ecuador, 57.69% in Perú, and 93.62% in Venezuela.³ Therefore, the extractive industry has been a fundamental driver of the economy in the Andean Region.

While the countries in the region share common characteristics, such as the major role played by natural resources in the economy, each has its own characteristics. In Bolivia, natural resource revenues are mainly based on the exploitation of minerals and natural gas, which accounted for 5.91% and 1.85% of GDP, respectively, in 2021. On the other hand, Colombia and Ecuador rely heavily on revenues generated by the oil industry, reaching 3.42% and 6.40% of GDP in 2021, respectively. Perú stands out mainly for its mining industry: income from minerals is a key element, the value of which has increased over the years and accounted for more than 10% of GDP in 2021.



Historically, the extractive industries sector has played a key role in the Andean region.

¹ Based on the World Bank data catalog for the period 2010–2019: <https://data.worldbank.org/data-catalog/world-development-indicators>.
² These extractive industries include metals, minerals, and land aggregates.
³ Based on data from the Harvard Atlas of Economic Complexity, <https://atlas.cid.harvard.edu/>.

Figure 1.1. Natural resources revenues in Bolivia (% of GDP)

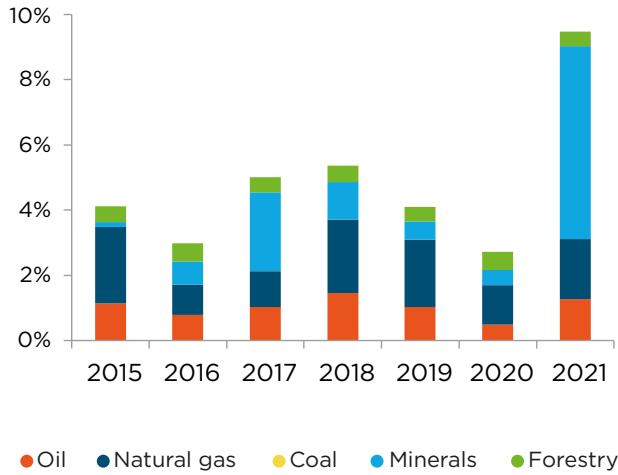


Figure 1.2. Natural resource revenues in Colombia (% of GDP)

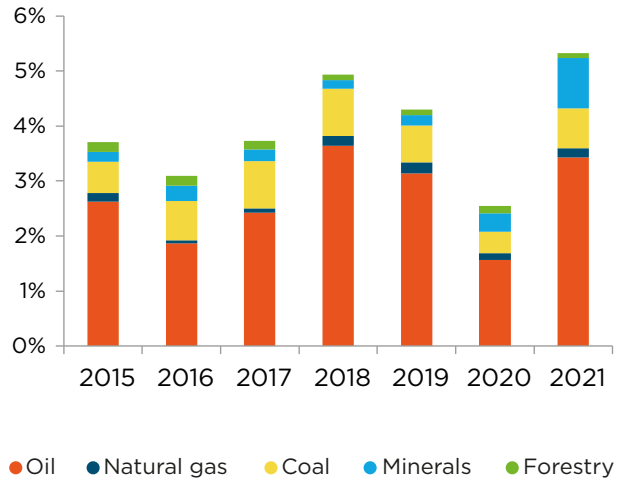


Figure 1.3. Natural resources revenues in Ecuador (% of GDP)

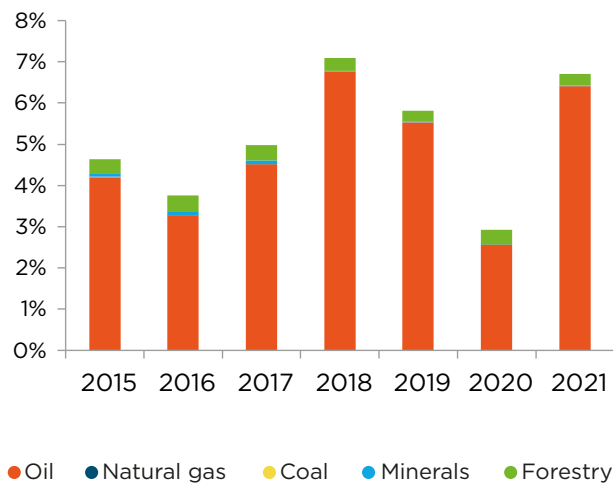
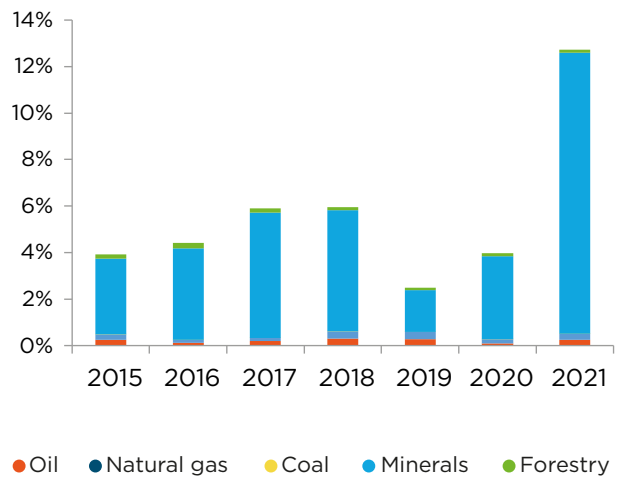


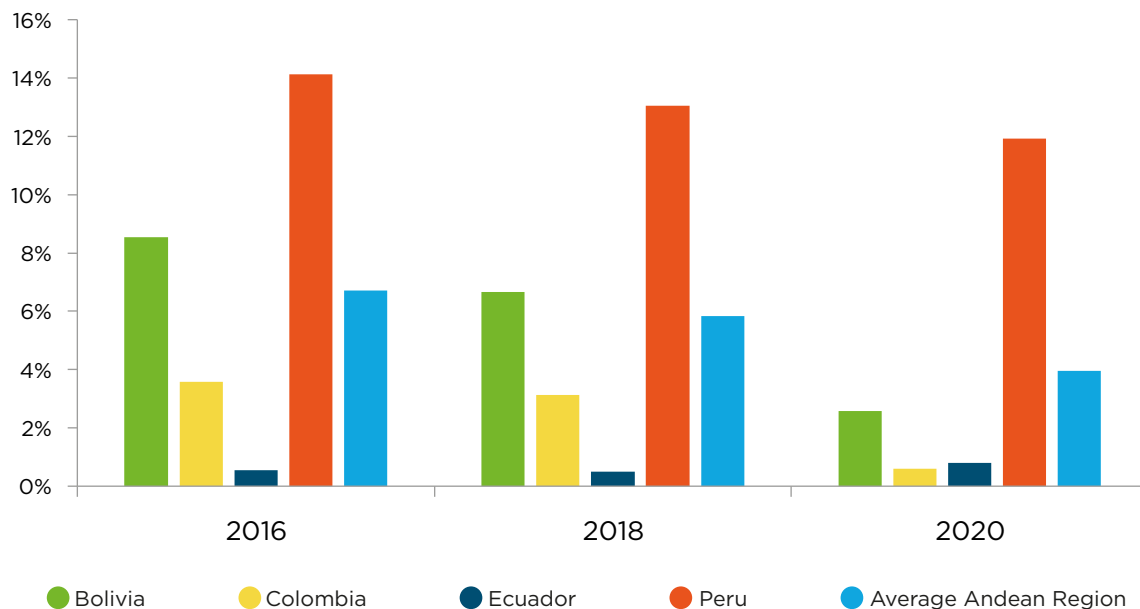
Figure 1.4. Natural resources revenues in Perú (% of GDP)



Source: Prepared by the authors with data from the World Bank (2023b).

According to the U.S. Geological Survey (USGS) (2023), Bolivia and Perú are countries with significant mineral reserves.⁴ In the 2023 USGS report, Bolivia was recognized as the world's leading lithium holder, with 21 million tons, and also has significant tin reserves, estimated at 400,000 tons. Perú stands out as one of the countries with the largest reserves of lithium, gold, silver, and copper. It is also the main producer of arsenic, with an estimated production of 28,000 tons in 2022. Despite these encouraging figures, it is important to note that the value of production of metallic minerals, metals, and coal has experienced a decline in the region over the years, according to ICMM (2018, 2020, 2022).⁵ This value, as a percentage of GDP, has decreased in Bolivia by almost 6 p.p. between 2016 and 2020, while in Colombia and Perú, this value has decreased by approximately 3 p.p. and 2 p.p., respectively. Only in Ecuador has a slight increase in this value been observed (0.24 p.p.).

Figure 1.5. Production value of metallic minerals and coal (% of GDP)



Source: Prepared by the authors using ICMM data ICMM (2018, 2020, 2022).

Note: The average production value for the Andean Region was calculated as a simple average and does not include Venezuela.

Regarding reserves and production in the oil sector in the Andean Region, countries such as Venezuela, Colombia, and Ecuador stand out. At the end of 2020, Colombia had reserves of approximately 2,000 million barrels, while Ecuador had 1,300 million barrels, according to the BP Statistical Review of World Energy (2021). Venezuela, on the other hand, has huge reserves of 303,800 million barrels, which represents more than 17% of the world's oil reserves. However, Venezuelan production has declined, being approximately 731,000 barrels per day in 2022, lower than Colombia's current production of 754,000 barrels per day, but higher than Ecuador's 481,000 barrels per day (Energy Institute, 2023).

⁴ According to the 2023 Mineral Commodity Summaries annual report.

⁵ According to the 2018, 2020, and 2022 Mining Contribution Index reports of the ICMM.

Regarding natural gas reserves, Bolivia and Perú have 0.2 and 0.3 billion cubic meters, respectively, each representing 0.1% of world reserves. Venezuela also has vast natural gas reserves, with an estimated 6.3 billion cubic meters, equivalent to 3.3% of the world total, according to BP (2021). In terms of production, Venezuela increased natural gas production from 28,100 million cubic meters in 2021 to 29,200 million in 2022.⁶ The same trend has been observed in Perú, where production increased from 11,500 million cubic meters to 13,800 million. However, in the case of Bolivia and Colombia, natural gas production decreased in 2022, declining to 13,400 and 12,400 million cubic meters, respectively (Energy Institute, 2023).

These figures show the fundamental role of natural resources and the extractive sector in the economies of the Andean Region countries. However, it is crucial to analyze the market they face. First, the Paris Agreement has established commitments for countries to mitigate global warming and its effects.⁷ This has led to a growing focus on the adoption of technologies and practices that reduce greenhouse gas emissions in extractive processes. It has also led to significant changes in the global energy structure, as greater emphasis has been placed on diversifying the energy matrix and seeking more-sustainable alternatives. As a result, fossil energy sources are losing ground to nontraditional renewable energies (Andrián & Manzano, 2023).

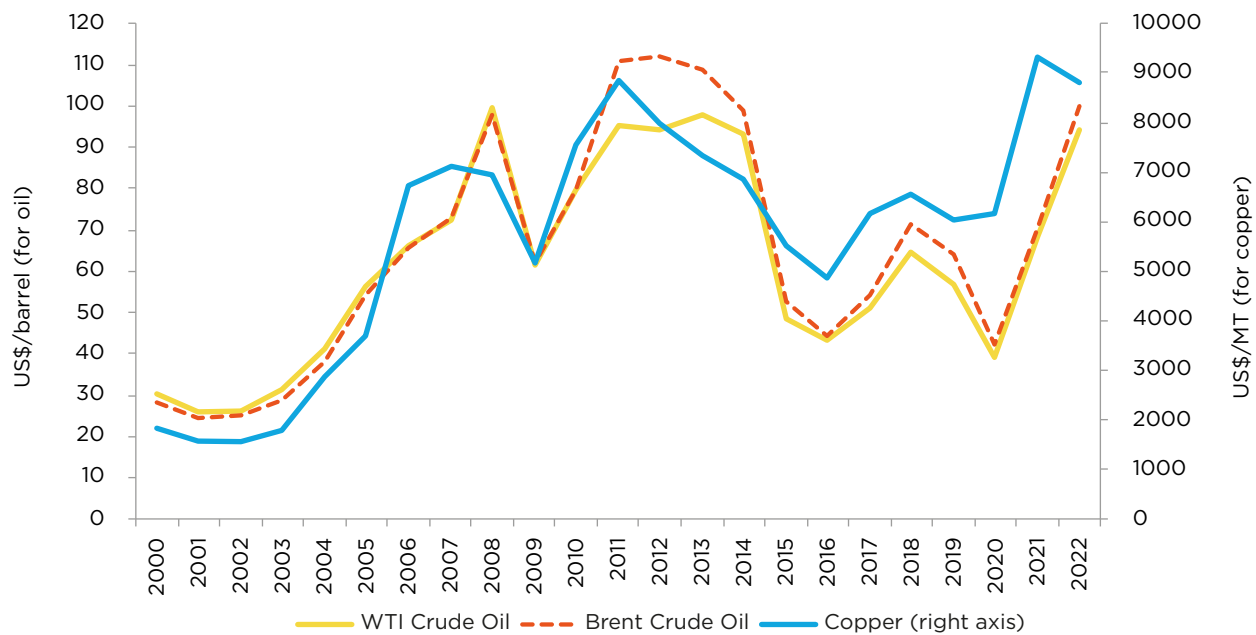
On the other hand, demand for metals and minerals is expected to increase in the coming decades (Rentería et al., 2022). The projected demand for lithium, cobalt, and graphite in 2050 could exceed the demand recorded in 2018 by more than 450% (Hund et al., 2020). In addition, demand for copper is estimated to continue to rise, from 26.9 to 33.5 million tons between 2020 and 2030 (Jones et al., 2021b).

However, external factors, which generate volatility in the raw materials market, should not be overlooked. For example, the COVID-19 pandemic generated an oil price shock due to a global decline in demand, especially in the transportation sector (Balza et al., 2020). However, Russia's aggression toward Ukraine has driven a recovery in oil prices in response to the refusal of Western countries to purchase oil and gas from Russia.



⁶ Does not include flared or recycled gas but does include natural gas produced for gas-to-liquids transformation.

⁷ The Paris Agreement is an international agreement on climate change adopted in 2015.

Figure 1.6. Prices of oil and copper

Source: Prepared by the authors with data from the World Bank's monthly "pink sheet" raw materials report.

In this context, the role of the sector in economic development becomes relevant. There are two realities in this situation. On the one hand, there will be geographic spaces (which, depending on the country, may be contained in a region or department, but in others, it may be the whole country) that will face a negative shock (due to the reduction in the demand for fossil fuels and coal) and others that will face positive shocks (due to the increase in the demand for minerals for transition). As Manzano (2014) argues, for decades academics and politicians warned about the potentially harmful effects of natural resources. This debate has evolved and indeed evidence has been found that resource abundance can be beneficial for development. Therefore, the discussion of policies should move towards a better understanding of how the extractive sector interacts with the rest of the economy. In addition, there is a debate in the literature on economic transitions regarding the displacement of the main economic activity that certain geographic areas of the region will face. As Gualdrón and Manzano (forthcoming) report, the evidence is mixed. Particularly in Latin America, experiences have not been as positive. Both realities imply a better understanding of the microeconomics of the sector is needed to enable a better design of policies and thus leverage the sector for its economic development.

In addition to this scenario, new demands on the sector are emerging from both the international community and civil society. As argued by Litvinenko et al. (2022), there lies tension between achieving environmental goals and achieving sustainable development objectives. In this regard, the International Resource Panel (2020b) points to the need to radically reduce global resource use to achieve both goals. As a result, a demand is being generated on the sector, including the private sector, to have environmental, social, and governance (ESG) policies. While there is pressure from investors to adopt these policies, the debate about their activities in the context of the Sustainable Development Goals, especially in developing countries, remains intense and the outcome unclear. To some extent, this is due to the lack of unified indicators that assess corporate compliance with ESG principles and the methodology for their application in relation to financial sustainability.

However, the pressure exists and, in some areas, international standards are beginning to be applied. As Lowe (2014) argues, in September 2002, during the World Summit on Sustainable Development, the launch of an initiative to create an international, voluntary data disclosure regime was announced: the Extractive Industries Transparency Initiative (EITI). In addition, the United States and the European Union require companies in the sector to declare the payments they make. There is also a similar standard in the Toronto Stock Exchange. Furthermore, there are private certifications, such as the Kimberly certification process for diamonds, which push for socially and environmentally sustainable production.

These circumstances reveal a challenging scenario for the exploitation and export of these natural resources in the countries of the region, making it essential to reevaluate the role played by natural resources and the extractive industry in the economies of the countries of the Andean Region. It is vital to reflect on how policymakers can draw on the lessons learned from these economies throughout history in order to effectively adapt to and address the challenges they face today.

1.2 Despite the sector's long tradition in the region, there are still challenges

The fundamental role played by natural resources and the extractive industry in shaping the economies and societies of the region is undeniable. Vast resource reserves and the development of extractive activities attract both domestic and international investment, which in turn drives the region's economic development and promotes the creation of supply chains. Moreover, as previously mentioned, this sector accounts for a significant percentage in exports and has a large impact on the fiscal revenues of countries in the region, despite its low tax collection (Andrián et al., 2020) and low contribution to total value added and employment (Ruiz-Arranz & Deza, 2018).

However, relying excessively on the extractive sector as the engine of the economy can generate vulnerability in countries, because they are more exposed to international price fluctuations and pay little or no attention to other productive sectors. Furthermore, weak institutional capacity can cause economic instability and structural imbalances and affect their sustainable development, as has been seen before and has been referred to in the literature as "the curse of natural resources" (Kronenberg, 2004).

There is a long-standing history in the region that transcends the extractive sector. An example of this can be seen in the history of Perú, during the guano era that spanned from the mid-19th to the beginning of the 20th century. Guano became an exceptional source of wealth for the country due to its deposits in the guano-producing islands off the coast, which were in great demand in agriculture worldwide.⁸ During this time, Perú experienced an unprecedented economic boom. Initially, guano had a positive impact on the stabilization of the Peruvian economy, as it drove the development of a strong export-based economy and generated a favorable trade balance for Perú in its relations with the global market (Cosamalón et al., 2011). However, overdependence on this resource had long-term economic consequences. As international demand began to decline and guano deposits were depleted, Perú faced a severe economic crisis. Lack of investment in other productive sectors and poor long-term planning left the country vulnerable to global market fluctuations.

⁸ Guano is a natural fertilizer rich in nitrogen and phosphorus that is formed from the accumulation of seabird droppings in coastal areas and on islands.

Something similar occurred during the rubber boom in the Amazon at the end of the 19th and beginning of the 20th century, mainly in countries such as Brazil, Perú, Bolivia, Colombia, Ecuador and Venezuela. Due to the industrial revolution, driven mainly by the automotive and other mass production industries, an important increase in the demand and valuation of natural rubber was triggered, as well as a significant increase in its price in the global market (Sierra, 2017). In this context, the export of rubber generated significant economic gains for the producing countries and the companies involved in its extraction and commercialization. Furthermore, cities such as Manaus in Brazil and Iquitos in Perú experienced rapid economic growth and became important commercial centers. However, rubber exploitation had significant consequences. The population growth and ethnic composition of the regions involved varied greatly, as the demand for labor attracted local and migrant workers to the extraction areas. In addition, the felling of rubber trees and their extraction and processing led to large-scale deforestation and the contamination of rivers and nearby bodies of water. Furthermore, rubber companies abused and exploited many of the communities in the areas and displaced them from their ancestral lands. Lastly, international competition, rubber availability in other regions and the development of synthetic rubber resulted in a decline in demand for natural rubber from the Amazon, which led to the end of the rubber boom and the need for countries to diversify their economies (Molina, 2020).

The boom of the 1970s is another example of the vulnerability of the Andean Region to external shocks. During this period, there was a significant increase in the international prices of raw materials, especially oil, which generated a period of accelerated economic growth known as the “oil boom.” Oil-exporting countries, such as Ecuador, benefited enormously, as export revenues multiplied and they experienced rapid economic growth (Posso, 2005). At the same time, the boom brought with it significant challenges and long-term consequences. When commodity prices began to fall in the 1980s, these countries were plunged into a deep economic and social crisis.

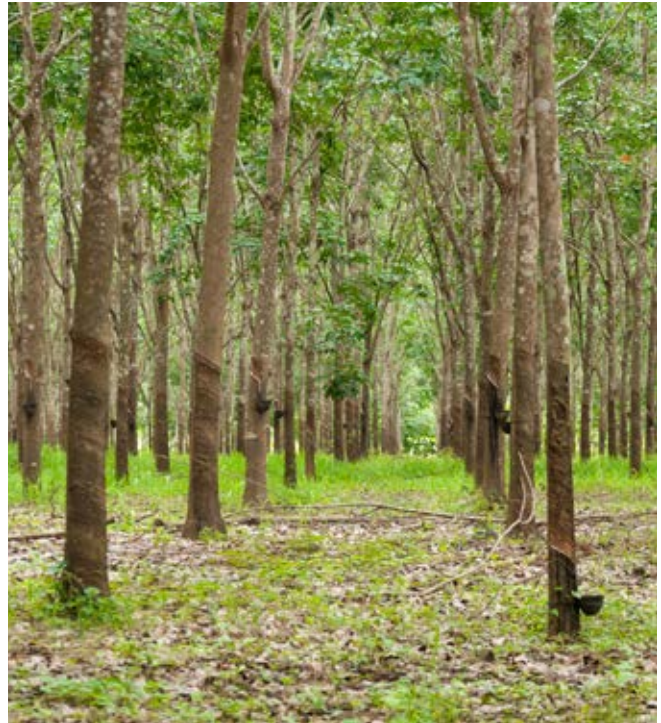
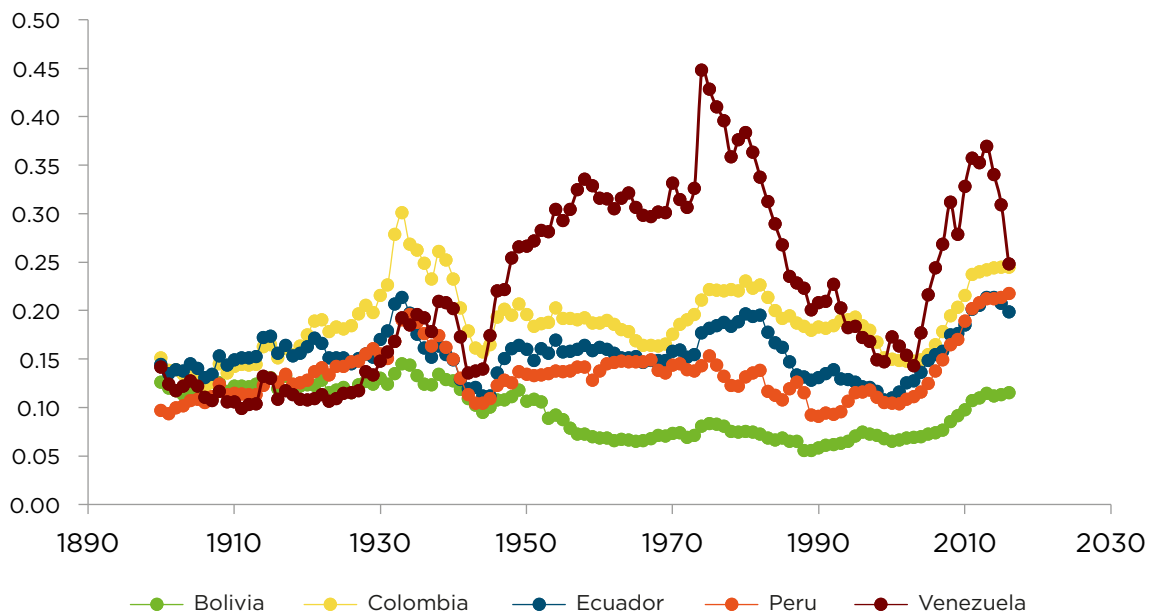


Figure 1.7. GDP per capita gap between the Andean Region and the United States (%)

Source: Prepared by the authors with data from Maddison Historical Statistics of the University of Groningen.

Note: The gap is calculated by dividing the GDP per capita of the corresponding country (Bolivia, Colombia, Ecuador, Perú, and Venezuela) by the GDP per capita of the United States.

Additionally, the debt crisis had a significant impact on their economies during the 1980s and 1990s. Countries were affected by a rapid increase in external debt, resulting from a combination of international borrowing and adverse economic conditions. In an attempt to manage their debt obligations, governments were forced to implement austerity policies and restructure their external debts as well as normal interest service (Ffrench-Davis & Devlin, 1993). These measures had serious implications for the region's economy. There was a contraction of public spending, cuts in social programs and a decrease in investment in infrastructure and development. In addition, the devaluation of local currencies and rising inflation affected the purchasing power of the population and economic growth. The debt crisis aggravated poverty, increased inequality, and generated high levels of unemployment (Ocampo et al., 2014). As a result, the countries of the Andean Region were faced with significant challenges in recovering from this crisis, rebuilding their economies, and seeking sustainable development paths in the decades ahead (Ocampo et al., 2014).

The experiences mentioned above reflect the problems that the Andean Region has faced throughout history. Despite having abundant natural resources and enormous potential, these countries are unable to take full advantage of opportunities due to low economic diversification and limited emphasis on technology and productivity. These factors, combined with the current context, create a series of challenges for the sustainable development of the extractive sector. The region appears to be on the verge of an extractive transition. On the one hand, hydrocarbon and coal production may be in decline (Andrián & Álvarez, 2023). On the other hand, demand for critical minerals for the energy transition



The region appears to be on the verge of an extractive transition.

(copper, cobalt, graphite, lithium, magnesium, nickel, and rare earth metals) is growing and the region has the opportunity to insert itself into the supply chain of these minerals (IEA, 2021). This presents three challenges. The first is the management of the phasing out of hydrocarbons and coal without repeating the crises that have been generated by these technological transitions in the past. The second is the management of a possible expansion of the mining sector in an economically and environmentally sustainable manner. The third is the management of the territorial imbalances that this transition will imply, because these natural resources are located in different territories.

In the environmental context, mineral, oil, and gas extraction has led to deforestation, soil degradation, water contamination, and greenhouse gas emissions in the countries of the region. These negative impacts on the environment can have long-term consequences for biodiversity, local ecosystems, and the communities that depend on them.⁹ Simultaneously, the ratification of the Paris Agreement requires the adoption of climate change mitigation and adaptation measures. To this end, it is essential to promote the transition to cleaner industries that are less dependent on natural resources, which is possible through greater economic diversification, the promotion of technological innovation, modernization of industry, investment in renewable energies, and the boosting of a green economy (Cheng et al., 2021).¹⁰

Another challenge is the high levels of conflict related to extractive projects and the search for social acceptance of these projects. The support and trust of the community and other stakeholders are critical factors for the long-term success of such projects. However, the lack of effective participation by and consultation of these communities in decision-making processes and low governance capacity can lead to social tensions and conflicts. Thus, it is essential to combine community participation and engagement with a constant effort to strengthen governance capacity (Balza et al., 2021c), as well as to encourage the creation of shared value for all parties involved.

Governance and transparency also pose significant challenges in the sector. Countries in the Andean Region are characterized by a low tax burden and rely heavily on revenues generated from natural resource exploitation (Andrián et al., 2020). This dependence is aggravated by rigid public spending. In this context, it is crucial to highlight the importance of strong fiscal institutions to maintain fiscal stability and address the development challenges that persist in the region, while considering the decline in expected long-term fiscal revenues due to the ongoing decarbonization process. To this end, each country must fully understand the effects of the transition to decarbonization and address the lack of sectoral studies on this topic, because this deficiency hinders informed decision-making.

In addition, it is critical to address the issue of transparency and accountability in an effective manner. While there are three organizations, EITI, FATF, and the Global Forum, that promote these principles, each of them employs different assessment methods. This diversity of approaches can create distortions or confusion in the message conveyed to decision-makers. It is crucial to ensure timely access to information on the ultimate beneficiaries for both civil society organizations and journalists in order to strengthen transparency in the process.

This could increase tax revenues, deter corruption, and improve the quality of concession and exploitation contracts, which in turn would increase public revenues and socio-environmental conditions at extraction sites (Andrián & Manzano, 2023).

⁹ In fact, these effects can affect the acceptance of extractive activity, as documented by Acosta and Lopez (2023) and Heikkinen et al. (2023).

¹⁰ This issue has been studied by Cheng et al. (2021) when analyzing the impact of the “Sustainable Development Plan for Resource-Based Cities” in China (2013–2020).

Furthermore, the lack of consistency in policies limits the capacity to generate adequate productive chains (Andrián & Manzano, 2023), which hinders the development of a more diversified and sustainable economy. As a result, this situation restricts employment opportunities and growth in other economic sectors. In order to promote balanced and resilient development in the Andean Region, it is crucial to promote policies and measures that foster the creation of productive linkages. This implies facilitating the integration of extractive activities with other sectors of the economy, such as manufacturing, agriculture, and tourism.

Finally, it is important to examine the role of technological development in the sector and the challenges associated with it. Currently, technology has become even more important due to global efforts to achieve the climate goals set out in the Paris Agreement. This scenario will pose significant challenges for the global production system as demand for raw materials increases in the coming decades. Successful implementation of disruptive technologies will be crucial in the energy transition and will enable more environmentally sustainable operation. In addition, the ability to exchange energy for other resources through technological advances will be critical to optimize resources and efficiently address growing demand (Hassler et al., 2021).

1.3 The sector as a transition leverage

Despite the reality described above, the sector can be leveraged to become the axis of productive transformation. While there is limited global experience on productive transitions derived from technological changes, there are examples, such as the case of the Ruhr Valley (Dahlbeck & Gärtner, 2019; Arora & Schroeder, 2022), from which lessons can be drawn for the region. Likewise, considering the potential new growth in the production of primary goods, due to the demand for minerals, Lederman and Maloney (2007) present case studies of countries that had production structures based on natural resources and moved to diversified economies. These case studies are interesting because the natural resource sector was part of this transition. Therefore, the extractive sector can be a lever for productive transformation. However, this implies addressing some policy challenges.

In this regard, there are a number of preconditions for the sector to support productive transformation. These issues have been widely addressed in the literature and thus we will not elaborate on them in this document. Nevertheless, they are still key issues that require attention.

A first precondition is to avoid or minimize the environmental impact of the sector. Clearly, this depends on national environmental regulation. Wolf et al. (2022) highlight the region's relatively poor performance in this regard. Therefore, the first key step is to adapt all national regulations to environmental preservation. Regarding the extractive sector, as highlighted by EITI (2021), a relevant first step is transparency about the impacts of the sector. The countries in the region that are members of the EITI are already on this path and it is important that the rest follow suit. Additionally, as highlighted in International Resource Panel (2020a), not only are regulatory issues key for the sustainable development of the sector, policy coordination and planning are as well. In other words, it is necessary to interconnect the governance of mining with that of other economic sectors, with a view to finding strategically planned development pathways. This is a major



**The sector can
be harnessed to
become the axis
of productive
transformation**

issue in the region, because one of the main challenges in the implementation of policies of any kind is the lack of coordination between public sector entities.

Another precondition is to have appropriate regulation for the sector. As highlighted by Sa and Espinasa (2018) and Balza and Espinasa (2015), the regulatory framework is essential for the sector's development. In this regard, Colombia and Perú have regulatory frameworks that, while having room for improvement, are very close to best practices. Now, as highlighted in Manzano et al. (2018), it is not only about the regulatory framework, but also about the fiscal regime; in this sense, Davis and Smith (2020) show the heterogeneity of fiscal regimes in the region, where sometimes the same country has regimes that generate few inefficiencies and others that generate high inefficiencies. Thus, it is also important to move toward systems that generate few inefficiencies.

Given these preconditions, we can think about the elements that the sector should take advantage of for a productive transition. A first element is social acceptance. In this respect, as noted in Chapter 2, it is vital to encourage the construction of shared visions and mutually beneficial agreements that can contribute to the mitigation of conflicts and the promotion of sustainable development. This implies fostering an inclusive and participatory dialogue that allows for the involvement of all stakeholders in decisions related to extractive activities. The main objective is to develop a collective vision of development in which extractive projects have a significant impact on improving the living conditions of communities. To this end, it is imperative to generate accurate and reliable information, guarantee the representation of diverse interests, and establish transparent and clear procedures.

Regarding fiscal issues, changes in the system are required to improve the financial situation of governments without compromising economic growth. To achieve this, it is necessary to reform the royalty systems, seeking greater territorial equity, reducing volatility in subnational revenues, and promoting efficiency in the use of resources. Additionally, as indicated in Chapter 3, it is essential to promote transparency and easy access to information concerning the final beneficiaries of the exploitation of extractive resources. This would improve tax collection, reduce money laundering, prevent corruption, and improve socio-environmental conditions at the extraction sites.

Another fundamental element is the development of effective productive chains to promote sustainable and equitable economic development. As highlighted in Chapter 4, long-term policies and strategies should be implemented to integrate local suppliers into the extractive sector supply chain and encourage research and development of local technology to promote innovation and generate greater value added in the region. It is also necessary to take advantage of the sector's positive externalities, which provide an opportunity to invest in the improvement of local education and the fostering of human capital development. It is equally crucial to effectively address negative externalities by implementing cost-effective youth labor programs to mitigate their negative impacts.

Regarding digitization, it is important to recognize its role in the extractive industry. The adoption of digital technologies presents a number of significant advantages, including improved operational efficiency, increased productivity, reduced costs, and more-effective optimization in the use of natural resources, as mentioned in Chapter 5. These advantages are essential to face the challenges associated with the energy transition and to ensure compliance with sustainability and social responsibility standards in the sector.



Lastly, the issue of including women, indigenous communities, and minorities in the sector cannot be overlooked. As explained in Chapter 6, an initial approach to achieving effective inclusion would involve changing gender perceptions and implementing educational programs to train women in technical and leadership roles. For indigenous communities, it is necessary to recognize their territorial rights and traditions in decision-making, while with regard to small- and medium-sized enterprises (SMEs), challenges related to a lack of financial resources and business formalization need to be overcome.

It should be noted that the region is in a good position to address and overcome the challenges in the extractive sector. Despite the obstacles and challenges mentioned earlier, significant opportunities are emerging that have the potential to catalyze positive change. This transformation can be achieved through the adoption of innovative approaches and the implementation of effective public policies, as will be explained in the following chapters.



SOCIAL LICENSE

2. MITIGATING CONFLICTS AND PROMOTING SUSTAINABLE DEVELOPMENT IN THE REGION

2.1 The level of social license toward the extractive sector varies across Andean countries

This chapter will address the importance of the social license to operate (SLO) in extractive industry projects (mining, oil, and gas), considering the sector's environmental, social, and economic impacts. The extraction of natural resources cannot be viewed as an isolated process, because it has concrete consequences, both positive and negative, at various levels, and the magnitude and nature of these consequences vary depending on the geographical proximity to the projects. Moreover, extractive projects involve multiple actors, including local communities; local, regional, and national governments; civil society; and even transnational entities, making them complex processes that underscore the need for responsible and sustainable management.

In this regard, the SLO is defined as the acceptance and support of the community and other stakeholders in the execution of an extractive project, which constitutes a critical factor for its long-term success. Therefore, this chapter analyzes strategies to understand what constitutes the SLO in the Andean countries, considering the various dimensions and factors involved in this process. It also presents some considerations for achieving responsible and sustainable management of extractive projects, respecting human rights, promoting dialogue and collaboration with the community, and fostering the creation of shared value for all stakeholders.

Initially, the term SLO was coined to refer to “non-formal” conditions for operation, in contrast to the legal license to operate granted by states. This term, which has evolved over time, was introduced in 1997 by James Cooney, the vice president of a Canadian mining company, and has since gained popularity (Boutilier, 2014), initially spreading in the mining industry and subsequently being adopted in other industries such as energy and agriculture. While there is no uniform definition of the SLO, it is generally understood as a social contract that exists between companies and communities (Moffat et al., 2016). This social contract can be tangible or intangible; what is important is that it evolves over time and is built through the participation of the different actors involved. This network of actors is unique for each project and can include local groups, different levels of government in a country, project-executing firms, and even international organizations such as environmental organizations.

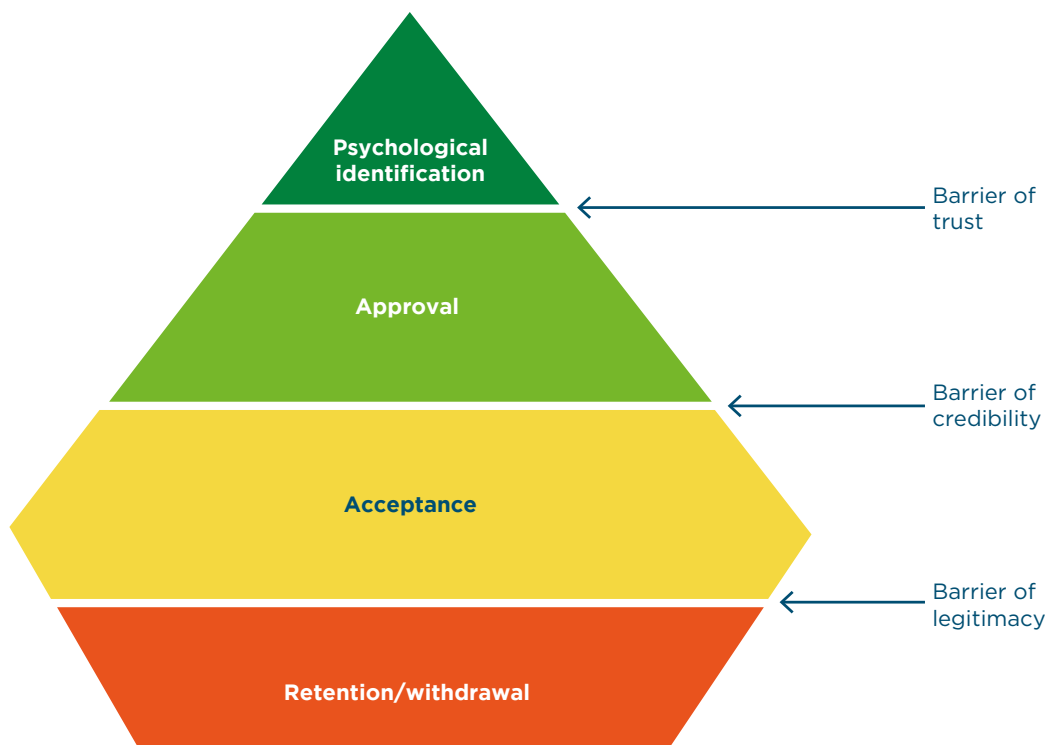
The composition and dynamics of interaction among the various actors can vary considerably, reflecting the inherent complexity in obtaining and retaining an SLO in the context of extractive sector projects.

In addition to the diversity of actors involved, the SLO can manifest itself at different degrees or levels. Thomson and Boutilier (2011) propose a pyramid model that establishes four levels of the SLO (see Figure 2.1): withdrawal, acceptance, approval, and psychological identification. The lowest level of the SLO is having the social license withdrawn or denied. This implies that the project is at risk of facing restrictions

on access to essential resources (e.g., financing, legal licenses, raw materials, labor, markets, and public infrastructure). The next level of the SLO is the acceptance of the project, which is the most common level of social license achieved by mining and oil projects. The third level corresponds to approval. At this level, formal negotiation occurs, establishing a definition of and agreement on the roles and responsibilities of the company and stakeholders. The fourth level is where stakeholders adopt what Thomson and Boutilier refer to as a “sense of co-ownership or psychological identification with the project” through collaborations, shared experiences, and exposure to common vulnerabilities. This level represents the deepest and longest-lasting form of the SLO and is where the community’s highest commitment to the project is observed.

These different levels of SLOs are defined by certain barriers that separate them. First, “legitimacy” is what distinguishes projects that have been rejected (i.e., projects for which the SLO has been withheld/withdrawn) from those that have been accepted by stakeholders through their participation according to the rules of the game. Second, “credibility” distinguishes projects that have been accepted from those that have been approved. Finally, “trust” separates projects that have been approved from those for which there is the maximum level of psychological identification. At this level, stakeholders have deep trust in the project and feel confident that their interests are being served and that the company will act fairly, even in unforeseen situations.

Figure 2.1. Pyramid model of the stages of social license to operate



Source: Thomson and Boutilier (2011).

In addition to the conceptual framework put forward by Thomson and Boutilier (2011), there are two other main models in the academic literature that address SLOs. The model proposed by Moffat et al. (2016) highlights the impact of trust in governance and of justice, both procedural and distributive, on the trust held toward the industry and, consequently, the SLO; the triangle model in comparison establishes three licensing dimensions: sociopolitical, market and community (Wüstenhagen et al., 2007). Despite their differences, trust emerges as a fundamental component in all three models. This poses a particularly important challenge in Latin America and the Caribbean (LAC), where levels of interpersonal and institutional trust are the lowest in the world and where the level of trust toward private companies is also very low (Keefer & Scartascini, 2022). This context of low trust in the countries of the region reinforces the importance of careful and transparent management of extractive sector projects. Efforts to build trust and credibility will be critical to obtaining and maintaining an LSO and may require different approaches in order to address the particularities and challenges of various environments.

In addition to low levels of trust, LAC has the highest prevalence of mining-related conflicts of any region in the world and those conflicts tend to be more violent than elsewhere (Andrews et al., 2017; Albrieu & Palazzo, 2020). According to data from the Observatorio Latinoamericano de Conflictos Mineros (OCMAL, Latin American Observatory of Mining Conflicts), which compiles information on conflicts in LAC over the last two decades, nine conflicts have been reported in Bolivia, sixteen in Colombia, eight in Ecuador, thirty-nine in Perú, and two in Venezuela. The most common causes of conflicts are related to environmental impacts derived from mining and the displacement of communities due to resource-exploitation activities and operations (Bebbington & Bury, 2013; Arce, 2014; Svampa, 2019). However, sometimes conflicts arise for the purpose of capturing rents for individual benefit rather than defending the legitimate rights and concerns of communities.

The social and economic costs due to conflicts around the extractive industry are immense. Betancourt (2016) reports that the use of violence in mining contexts in LAC has resulted in murders, personal injuries, displacements, threats, and criminalization cases, among others. Likewise, conflicts generate significant costs for firms, workers, and communities. Franks et al. (2014) identify the greatest costs for firms due to conflicts around extractive projects as being associated with lost productivity due to delays. The authors analyze the cases of several mining projects around the world, including one in LAC, and found that costs due to delays can represent US\$20 million per week. In addition, conflicts generate immediate opportunity costs, in terms of economic resources allocated to resolve the conflict, as well as opportunity costs in the medium term by reducing incentives for the private sector to invest in new projects (Chong & Haslam, 2020).

Thus, it is important to study the conflict around extractive industries. Understanding its causes is fundamental and taking actions that directly address those causes can prevent many losses. Balza et al. (2021c) conducted a nationally representative survey in the five countries of the Andean Region. The results of this study indicated that the major determinant of the SLO is the perception of governance (see



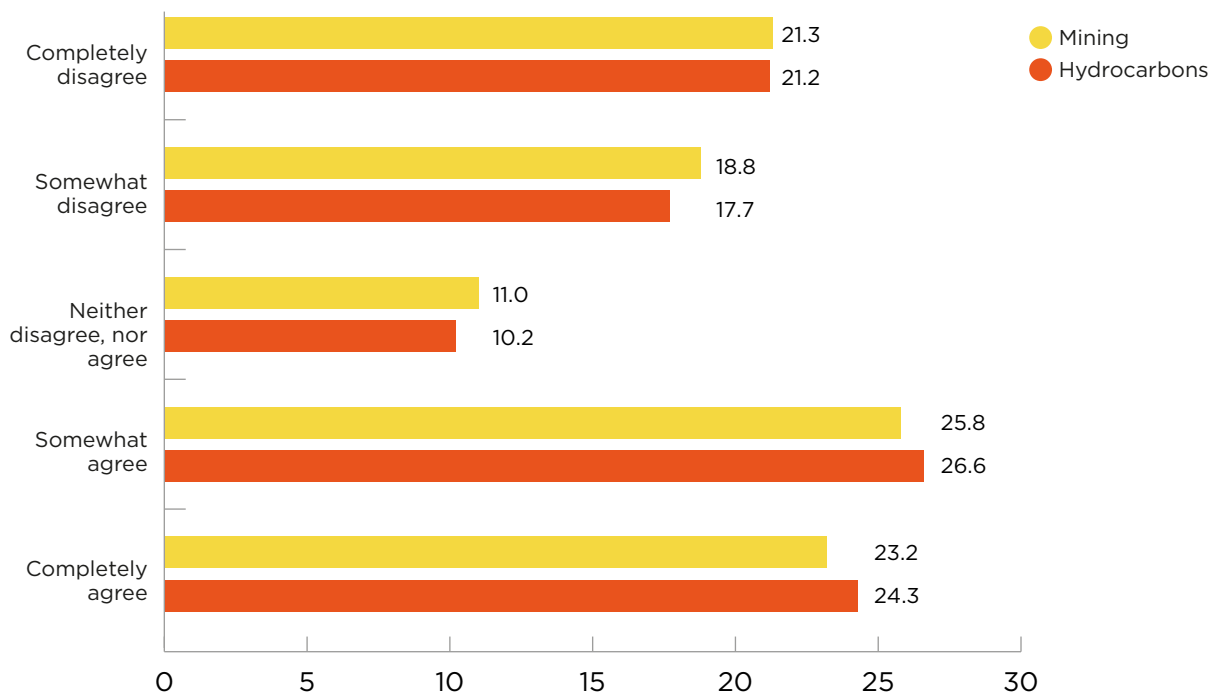
Efforts to build trust and credibility will be fundamental to achieving and maintaining an LSO.

results for responses to the governance question in Figure 2.2)¹. Additionally, the authors found that a better perception of governance is related to a higher level of the SLO.

This positive correlation is also observed in relation to perceptions of distributive and procedural justice. The former concept refers to the way in which the economic benefits of the sector are distributed, while the latter focuses on the decision-making process and the involvement of all relevant stakeholders.

Figure 2.2. The number of people agreeing with the government's enforcement of environmental and social laws in mining and oil projects in the Andean Region is higher than the number of people against.

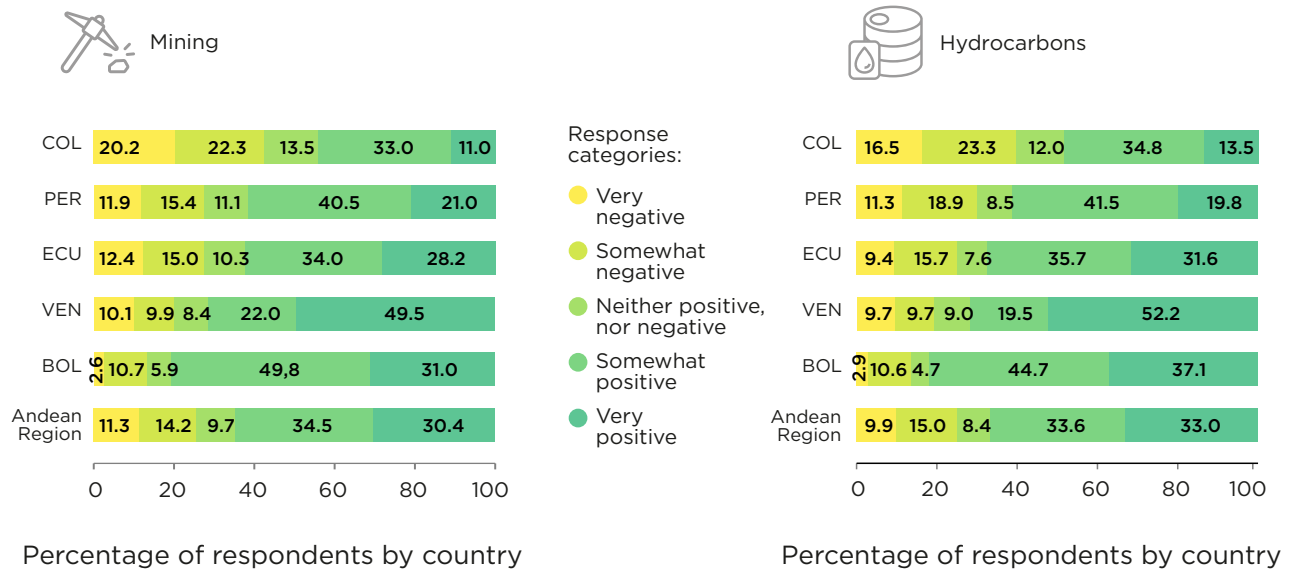
Government enforces environmental and social standards in mining, oil, and gas projects



Source: Balza et al. (2021c). Data aggregated for all countries in the sample: Bolivia, Ecuador, Colombia, Perú, and Venezuela (N = 5,312).

The results of the study by Balza et al. (2021c) are quite similar when comparing perceptions of the mining industry and the hydrocarbon (oil and gas) industry. However, the authors find significant differences between countries. Figure 2.3 shows the results of SLO level for each of the countries in the Andean Region, where it can be noted that, while the vast majority of citizens in the region have a positive stance toward the industry, Bolivia stands out as the country with the highest level of SLO, while Colombia has the lowest level. On the average for Bolivia, around 13.4% of the surveyed population has a negative stance toward the industry, while this number rises to 41.1% in Colombia.

¹ It is worth clarifying that 'governance' is a very broad term and refers here to only one aspect of governance, that related to the state's ability to enforce environmental and social laws.

Figure 2.3. Citizen perception of extractive industries

Source: Balza et al. (2021c).

Note: Responses to the question: "Do you consider oil and gas mining/exploitation for the country to be...?", posed to a nationally representative sample in each of the countries.

To contextualize these results within the literature on SLO, it is important to consider that the SLO operates at different levels and involves various actors. Regarding the levels, Lesser et al. (2021) propose a model that includes a community level of the SLO and a social level of the SLO, which pertains to the population beyond the direct influence area. The survey conducted by Balza et al. (2021c) focuses on social SLO, complementing existing literature that has mainly concentrated on the relationship between the industry and local communities (Prno & Slocombe, 2012). The study of social SLO aligns with the perspective presented by Meesters et al. (2021), who view SLO as a comprehensive concept of legitimacy based on significant political deliberation that goes beyond seeking approval solely from local communities.

In terms of the diversity of actors, it is essential to emphasize that the set of actors involved in the SLO of a particular project extends far beyond the host communities. Boutilier (2014), for example, introduces the concept of a network of involved actors rather than a single community, recognizing that communities often do not exist as cohesive entities with a clearly articulated set of priorities. Nowadays, transnational institutions play a crucial role in SLO. In a recent study, Reeder et al. (2022) apply spatial econometrics analysis and find that environmental justice organizations are the primary disseminators of mining conflicts. They provide information and resources that reduce barriers to collective action through interpersonal networks. The authors suggest that this is one of the reasons why mining conflicts in Latin America and the Caribbean tend to cluster in space and time. Interactions among different actors through networks and their reciprocal influences can create spatial and temporal patterns in the distribution of mining conflicts. This underscores the importance of considering not only local communities, but also a wide range of actors when examining SLO and conflict management in extractive sector projects.

One way to delve deeper into social perceptions of the extractive industry is to study the narratives surrounding it.² Shiller (2017, 2020) highlights the importance of narratives about concrete economic outcomes. The stories that people tell themselves and others connect human values and needs to the activities we undertake and this can have concrete impacts on the economy. For example, social narratives can affect decisions to start a business, decide how much to spend, or when to hire a new worker in a company. Similarly, social narratives around the extractive industry can determine an individual's decision to protest against a new mining project, vote in a referendum on a mining project, or contribute resources against an environmental cause.

Balza et al. (forthcoming, c) analyze the narratives surrounding mining and hydrocarbons. For this purpose, they focus on understanding what the main metaphors are by applying Zaltman's metaphor identification technique (ZMET). The ZMET methodology accesses the unconscious mind through the use of images to understand people's perceptions of a particular topic and uncover their unexpressed needs, impulses, and emotions. Imagery as metaphor can bring the unconscious to a level of awareness, reveal cognitive processes and emotions beyond literal language, and influence or change perceptions and decision-making. The ultimate goal of ZMET is to elicit the main deep metaphors prevalent in each individual's narrative. Nine key deep metaphors appear repeatedly in the human narrative: balance, connection, containment, control, strength, model,³ journey, system, and transformation.⁴ Each deep metaphor has a set of submetaphors to capture the feelings expressed in greater detail (Coulter et al., 2001; Zaltman, 1997, 2003; Zaltman & Zaltman, 2008).

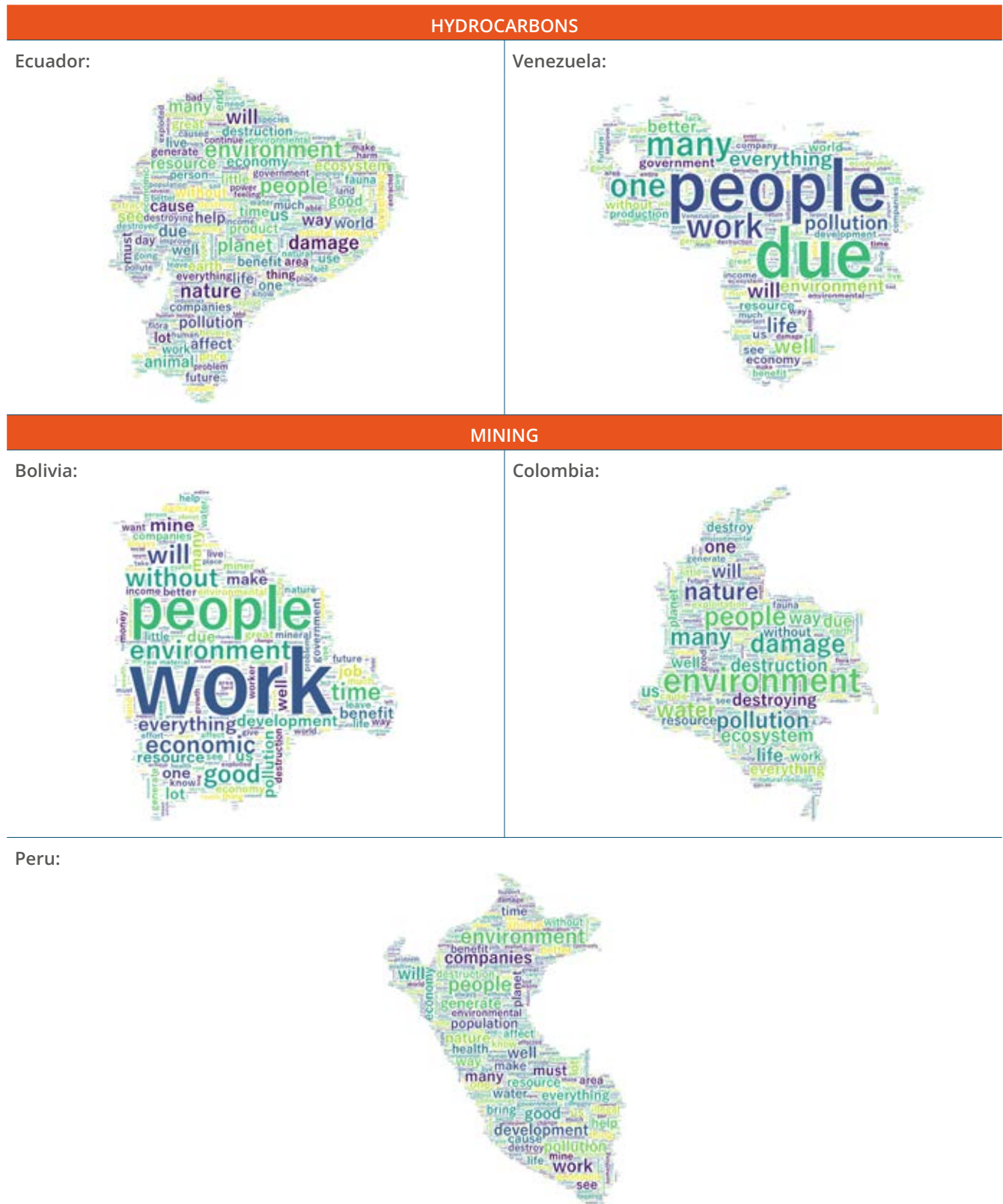
The study by Balza et al. (forthcoming, c) illustrates the power of these types of techniques for gaining an understanding of people's perceptions and attitudes toward the extractive industry. The procedure involved about 600 participants in each of the Andean countries, who were asked to choose an image describing the extractive industry. Subsequently, they were asked to describe the image in detail and indicate why it represented the industry for them. Figure 2.4 shows the word clouds for each of the countries with the words that were used most frequently by the participants. The size of each word is proportional to the frequency with which citizens used it in their descriptions. Despite the heterogeneity between countries, the use of terms such as "environment," "life," "nature," and "contamination" stands out for its frequency in the Andean Region, showing that this is one of the major concerns of citizens in the region when they think about the extractive industry. Similarly, in the countries where according to the study by Balza et al. (2021c) the industry has higher levels of SLOs, such as Bolivia and Venezuela, the word "work" stands out. It is possible that it is precisely the consideration of job generation as a positive characteristic of the industry that is the reason for this better perception in these two countries.

² Shiller (2017) defines the study of narratives in economics as the study of the diffusion and dynamics of popular stories, especially those of human and emotional interest. Stories motivate and connect activities to deeply felt values and needs. Together, these stories constitute the popular narrative.

³ Called an ideal in English, it refers to a standard or principle to be pursued.

⁴ A tenth metaphor, nature, was excluded from the study because it is tautological in this case, given that the extractive industry has an intrinsic relationship with nature.

Figure 2.4. What do citizens think about the extractive industry in the Andean Region?



Source: Prepared by the authors, using data from the work of Balza et al. (forthcoming, c). The text provided by the participants answers the following question: How does this image represent your thoughts and feelings about the impact of the mining/oil extraction industry in your country? (The words in the question were excluded from the word cloud, as some people repeated the question when answering)..

In addition to the frequency of words, the text that citizens use to describe the extractive industry is analyzed in order to uncover the main underlying metaphors. The predominant metaphors in the Andean Region are those of balance, strength, and transformation. The metaphor of balance is used to denote imbalance, characterizing the industry as a “predator” that preys on less-fortunate communities or manipulates governments. The following quoted text exemplifies this perception:

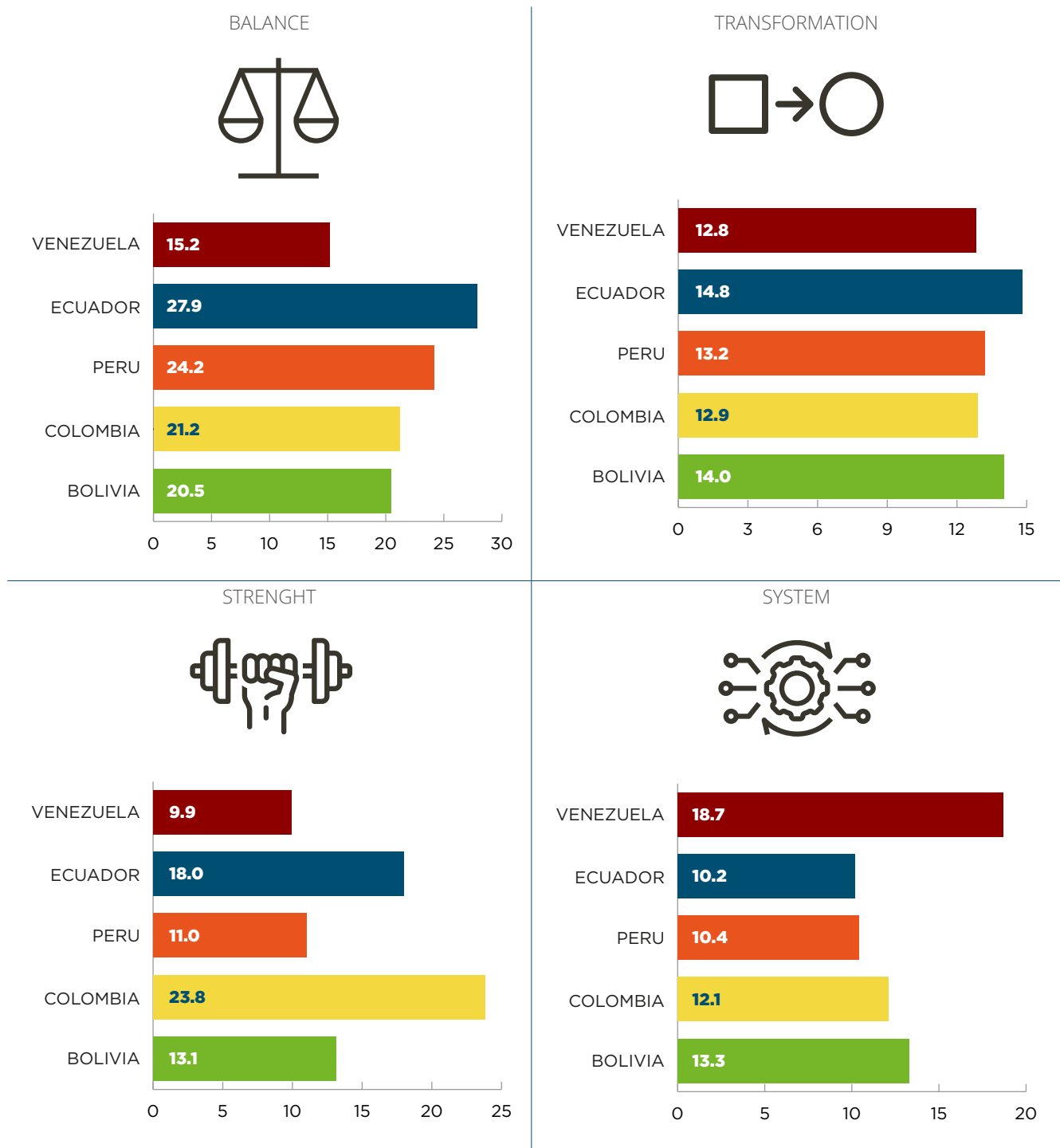
“Peru is a country with an economy sustained by the mining extractive activity of foreign companies, but the development of the regions where resources are extracted is non-existent despite the high royalties. So, the problem also depends on the regional governments in those places that do not develop public policies to reduce high rates of poverty, exclusion, and marginalization. Thus, the issue has several facets that complicate the well-being of those who have less (man, Peruvian, 37 years old).”



The balance metaphor was the primary metaphor in Bolivia, Ecuador, and Perú. Additionally, it was the second primary metaphor in the case of Colombia and Venezuela.

The results of the study by Balza et al. (forthcoming, c) in different countries of the Andean Region reflect a diversity of perceptions and attitudes toward the extractive industry, as expressed in the metaphors chosen by the participants to describe them. In Colombia, the country in the region with the highest proportion of citizens against mining (Figure 2.3), the strength metaphor was the most popular among study participants. This metaphor was commonly used to indicate that the industry attacks and harms both nature and society, threatening survival and stability. This result indicates a negative perception of the extractive industry in Colombia and underscores the need for measures to address these concerns. In contrast, in Venezuela, which is the country in the region with the highest proportion of citizens supporting mining (Figure 2.3), the most popular metaphor was that of the system. This metaphor was used to represent a systematic pattern of interconnected steps leading to progress. This result reflects a more-positive perception of the extractive industry and suggests that Venezuelans may be more willing to accept mining if they perceive it as contributing to the country's development. Figure 2.5 shows the proportion of citizens in each country for whom the primary metaphor is balance, strength, system, and transformation. This last metaphor is mostly used with a positive connotation of potential economic prosperity and stands out for its consistent appearance among countries.

Figure 2.5. Main metaphors used to describe the extractive industry



Source: Source: Balza et al. (forthcoming, c).

Note: in Bolivia, Colombia and Perú, the metaphors refer to mining, while in Ecuador and Venezuela, they refer to hydrocarbons. The numbers inside the bars indicate the percentage of the sample in the study that has the metaphor in question as its main metaphor.

2.2 The SLO involves significant trade-offs⁵ for the public

One of the main challenges facing Andean countries is to leverage the revenues from the extractive industry for economic growth, leading to greater social investment, improved infrastructure, and a reduction in poverty and inequality (Pérez, 2010). To achieve this, it is essential to understand how citizens assess various aspects (both positive and negative) of the extractive industry, recognizing that there are trade-offs to be made whether it is accepted or rejected. Discrete choice experiments (DCE) are a methodology used to measure individual preferences and assess trade-offs in decision-making involving multiple attributes. In these experiments, participants are presented with a series of scenarios or alternatives with specific attributes and asked to choose their preferred option. The attributes can be economic, social, or environmental variables and they are systematically manipulated to analyze how they influence individuals' choices.
















Most studies that use DCE to evaluate individual preferences regarding mining have been conducted in developed countries. Findings reveal that employment is one of the most valued attributes by participants, followed by housing prices and impacts on the environment and local culture (Ivanova et al., 2007; Ivanova & Rolfe, 2011; Gillespie & Kragt, 2012; Windle & Rolfe, 2014; Rolfe & Windle, 2015). However, there is also heterogeneity in preferences, with different results obtained regarding the relative importance of attributes in different geographic contexts and population groups (Spyce et al., 2012; Que et al., 2015, 2018). Furthermore, the combination of attributes in choice scenarios can have a significant impact on policy estimates (Rolfe & Windle, 2015). The variability in preferences in different geographic contexts and among different population groups underscores the importance of considering multiple perspectives and specific circumstances when designing and implementing policies or projects related to the extractive sector.

Balza et al.'s study (forthcoming, a) is the first to use a DCE to assess citizens' preferences in the Andean Region regarding mining. This study is in the data collection phase and involves a sample of over 2,400 citizens in Colombia, Ecuador, Perú, and Venezuela. The trade-offs considered in this case are based on five relevant dimensions in the Andean Region: environmental impact, governance, procedural justice, local job creation, and government revenue through royalties and taxes. The last variable is used to calculate a monetary value that captures citizens' valuation of the other four categories. In this context, citizens are informed that the government has a certain level of costs to cover and in the absence of revenue sources such as royalties from the extractive industry, the government must resort to other income sources, which could include taxing the population.

The DCE designed by Balza et al. (forthcoming, a) proposes three possible levels (low, medium, and high) for each of the dimensions assessed. In this experiment, study participants are asked to compare three different scenarios, each represented by a different company competing for the license to a mining project. Each company has a unique configuration of levels for each dimension, which would be implemented if they are granted the license to exploit the mineral resource in question. Participants must select the company that, in their opinion, would be the most suitable for carrying out the project. They repeat this exercise in evaluating a total of seven scenarios (Figure 2.6 present an example of one of the scenarios).

⁵ Trade-offs refer to the balance reached between two or more desirable but incompatible characteristics, in which compromise involves yielding on the ideal degree of each characteristic.

Figure 2.6. Example of a card used in a discrete choice experiment regarding mining in the Andean Region

| Dimension | Company A | Company B | Company C |
|---|--|---|--|
| 1. Environmental impact | Medium  | High  | Low  |
| 2. Time to respond to government | 1 week  | 1 month  | 3 days  |
| 3. Quality of meetings with communities | High  | High  | High  |
| 4. Local jobs generated | 1,000  | 1,500  | 2,000  |
| 5. Reduction in your 2003 taxes | - USD 2  | - USD 5  | - USD 2  |

Source: Balza et al. (forthcoming, a).

The results of this study provide insight into the relative valuation of the different dimensions, both positive and negative, that characterize the extractive industry. However, this exercise should be expanded in the future to incorporate the inherent complexities of each of the proposed dimensions. For example, job creation in the extractive industry involves several aspects that are important to citizens when evaluating the industry. In addition to the number of new openings, factors such as the total duration of employment, job safety conditions, and the opportunity to acquire new skills must be considered (Narrei & Ataee-pour, 2020). This same complexity is present for each of the dimensions studied.

A very important dimension that the authors independently study in Balza et al. (forthcoming, b) is distributive justice. In this study, citizens from Andean countries are asked to assess a series of scenarios to measure their preferences regarding the distribution of mining royalties. These preferences are

evaluated by analyzing the trade-offs between economic efficiency⁶ and equity, considering differences based on wealth (wealthy municipalities versus poor municipalities) and environmental impacts caused by mining (high versus low). Participants are randomly assigned to treatment and control groups to evaluate an experimental design inspired by Bruner (2018), which is based on decisions made behind Rawls' "veil of ignorance" (Rawls, 1971), combining the Fair Equality of Opportunity principle by Rawls⁷ and the Difference Principle.⁸

All participants are asked to select the royalty distribution proposal they consider fairest. Each proposal outlines how mining royalties would be distributed among four municipalities. The proposals vary in the degree of inequality in royalty allocation, the level of efficiency (in terms of the total amount of resources to be distributed), and environmental compensation (i.e., whether municipalities with higher environmental impacts will receive a greater amount of royalties). The choice of those participants assigned to the control group does not affect the payment they receive for their participation in the experiment. In contrast, participants assigned to the "veil of ignorance" treatment receive one of the payments corresponding to the proposal they choose. Rawls coined the term "veil of ignorance" because the selection of the distribution, in this case the proposal, is made without knowing to which municipality the person will be randomly assigned. This way, participants select the proposal of their preference, considering that within the selected proposal, they might end up receiving either the highest or lowest payment in the distribution.

Figure 2.7 shows the results of the experiment, which was conducted online with 2,439 citizens in Colombia, Ecuador, Perú, and Venezuela. In both the control and treatment groups, the most popular proposal is proposal 4, which favors efficiency at the expense of greater inequality and offers environmental compensation. The least popular proposal is the one that offers greater equity at the expense of lower efficiency and no environmental compensation.

This suggests that citizens in the Andean Region value economic efficiency more than equity when allocating resources derived from mining activity. However, they also take into account environmental compensation, which is reflected in a greater preference for proposal 4 than for proposal 2. Likewise, statistically significant differences are found between the control and treatment groups⁹ in terms of the selection of all proposals except proposal 1. It is important to mention that proposal 4 is the proposal with the most extreme values and that these differences between the control and treatment groups persist, even when controlling for the risk profile of the individuals. These findings are relevant for understanding how aspects of equity, efficiency, and environmental impact can influence informed decision-making regarding mining policies.



Citizens in the Andean Region value economic efficiency over equity in the allocation of resources derived from mining activities.

⁶ This term refers to the effectiveness in the use of resources to produce goods, which, in this case, is reflected in a greater volume of royalties to be distributed.

⁷ This principle implies that people from different economic backgrounds, but with similar motivation and talent, should enjoy the same opportunities.

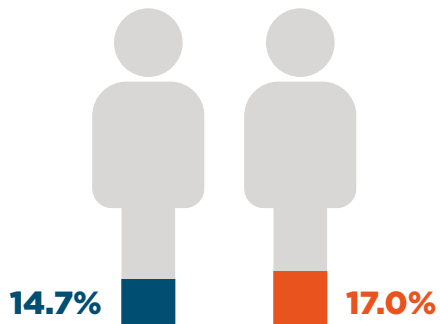
⁸ This refers to the well-known Rawlsian postulate according to which society should be organized according to the maximization of the welfare of the most disadvantaged individual.

⁹ Pearson $\chi^2(3) = 43.7046$, p -value = 0.000.

Figure 2.7. Percentage of people selecting the different royalty distribution proposals according to treatment

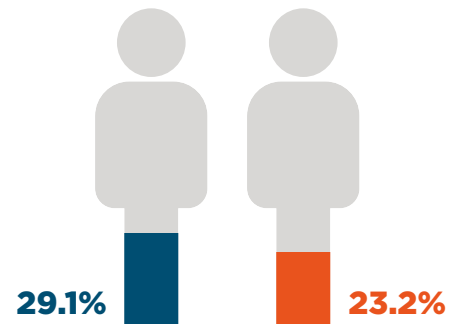
Proposal 1:

Low efficiency, less inequity,
no environmental compensation



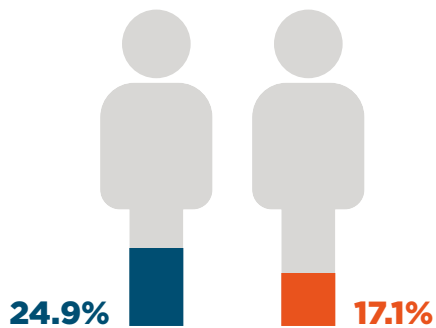
Proposal 2:

High efficiency, second most inequity,
no environmental compensation



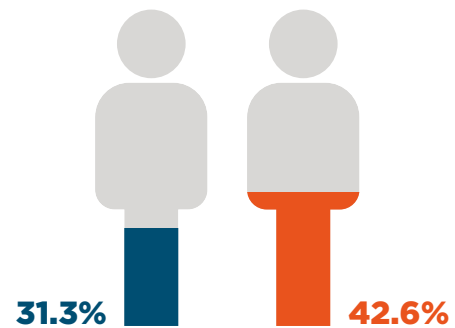
Proposal 3:

Low efficiency, second lesser inequity,
with environmental compensation



Proposal 4:

High efficiency, greater inequity,
with environmental compensation



Source: Balza et al. (forthcoming, b). This graph includes results for Ecuador, Colombia, Perú, and Venezuela.

Note: The values in blue correspond to the control group and those in orange to the treatment group. The people outlined in shades indicate the proportion of the distribution of participants who select the corresponding proposal in each treatment.

2.3 Fostering inclusive and participatory dialogue contributes to mitigating conflicts and promoting sustainable development that benefits all stakeholders



It is essential to establish shared benefit agreements capable of mitigating conflicts and promoting sustainable development that benefits all the involved stakeholders.

In this chapter, we have explored topics related to Social License to Operate (SLO), motivated by the high level of conflict surrounding the extractive industry in Latin America and the Caribbean. We found that SLO at the national level varies significantly among countries but, in general, is high in the Andean Region. The narrative surrounding the industry focuses on environmental issues in those countries with lower SLO levels and on job generation in those with higher SLO levels. We also analyzed citizens' preferences in the region regarding the distributive justice of royalties generated by the industry and found that economic efficiency is relatively more highly valued compared to aspects such as equity and environmental compensation.

While industry-level SLO in the Andean countries is not sufficient to encompass the complexities and specifics of individual projects, it provides valuable context that can enrich more-detailed analyses of these projects.

Additionally, it is important to highlight that we found similar results for both mining and oil and gas; therefore, we did not focus on the differences between these sectors. However, the context of energy transition is leading to an expansion of mining and a contraction of hydrocarbons, which may have different impacts on public perception of these industries.

Furthermore, we emphasize the importance of analyzing citizens' preferences in a sector with multiple trade-offs, such as those between efficiency and equity or between positive and negative externalities. The dichotomies faced by countries in the Andean Region underscore the need to foster inclusive and participatory dialogue among various stakeholders. This will enable the construction of a shared vision of development in which extractive industry projects result in improved living conditions for communities. It is essential to establish shared benefit agreements capable of mitigating conflicts and promoting sustainable development that benefits all stakeholders. This will not only contribute to a fairer distribution of economic benefits, it will also help strengthen trust and cooperation among different actors in mining and oil regions. Building common visions and shared benefit agreements in regions where extractive activities are conducted is crucial. Dialogues with communities should incorporate topics that are relevant to them, regardless of whether they are directly associated with the projects.

The Latin American Extractive Sector Group (GLASE, for its acronym in Spanish) has suggested some guidelines for creating multistakeholder dialogue instances that enable the participation of all interested parties in decisions related to extractive activities and their impacts on the territory (IDB, 2020). Some proposed procedures include the generation of rigorous and valid information about the impacts and benefits of extractive projects, the participation and representation of various interests, the establishment of a technical secretariat to facilitate and systematize dialogue, the definition of clear procedures, and the training of participants. Likewise, there is an emphasis on coherence with territorial development plans, the definition of shared benefits, social communication and education, monitoring of agreements, and the establishment of shared governance. An example of this is the construction of the 2030 vision for the mining sector in Perú and its subnational implementation in Moquegua and Cajamarca (Walter et al.,

2021), as well as the proposal for inclusive mining in Colombia, led by the Dialogue Group on Mining in Colombia (GDIAM, for its acronym in Spanish).¹⁰

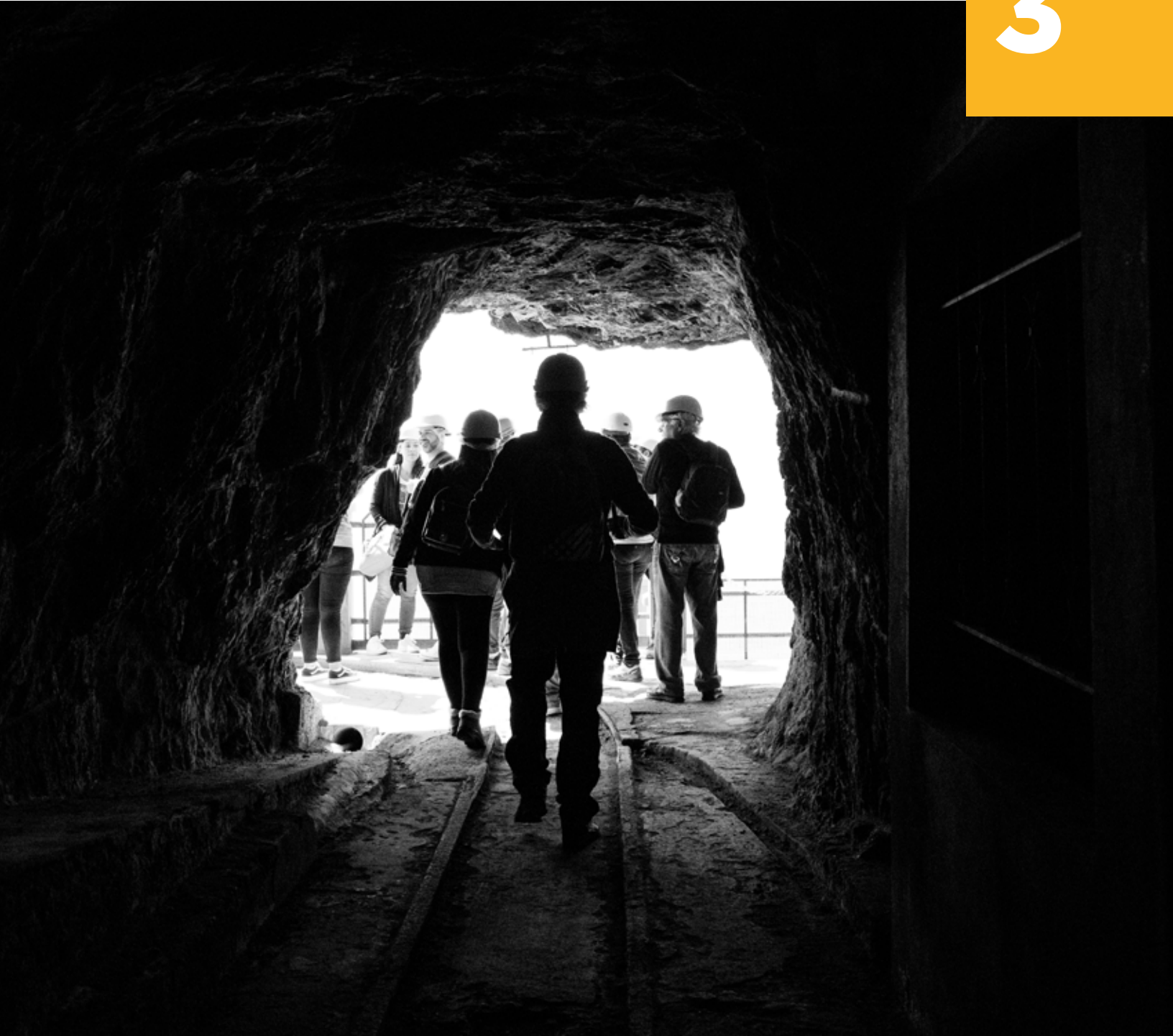
These strategies contribute to building trust among the stakeholders and interested parties. However, building trust depends on the involved parties' feeling genuinely heard and integrated into the dialogue around the extractive industry. In this way, another proposal from GLASE, as recorded in IDB (2020), refers to the effective implementation of free, prior, and informed consent (FPIC). This involves establishing clear and transparent mechanisms and processes for conducting consultation, ensuring that indigenous and tribal communities have access to relevant information and the opportunity to participate fully in decision-

making. The proposal also emphasizes the importance of ensuring that the consultation is genuinely free and informed, avoiding any form of coercion or undue pressure on ethnic communities. The goal is to provide communities with the opportunity to assess the potential impacts of proposed measures and negotiate fair and equitable agreements that safeguard their rights and well-being.

Moreover, it is essential that environmental protection and care are a priority for the extractive industry, due to the intrinsic importance of the environment and its being a concern for the public. An example of how this has been promoted through public policy is through the national mining policy and innovation roadmaps in Chile.¹¹ Additionally, the Chilean Senate and the Foundation for Encounters of the Future (Senado de Chile and Fundación Encuentros del Futuro, 2022) propose some key elements for sustainable mining, including the protection of water resources and local biodiversity, as well as the financing of strategic projects and innovation promotion. They also recommend promoting recycling and circular systems in the mining industry by favoring public policies that encourage the remanufacturing and renewal of inputs to increase material efficiency and reduce waste from mining processes.



¹⁰ For more information, see <https://gdiam.org/publicaciones>



INSTITUTIONS

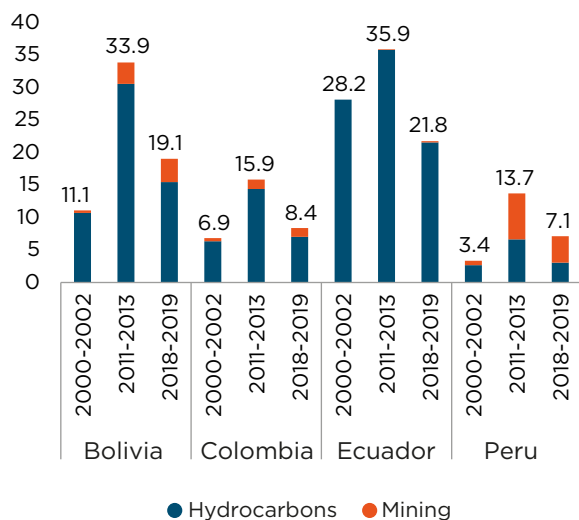
3. FISCAL AND TRANSPARENCY INSTITUTIONS FOR THE TRANSITION

3.1 The link between national finances and commodity prices

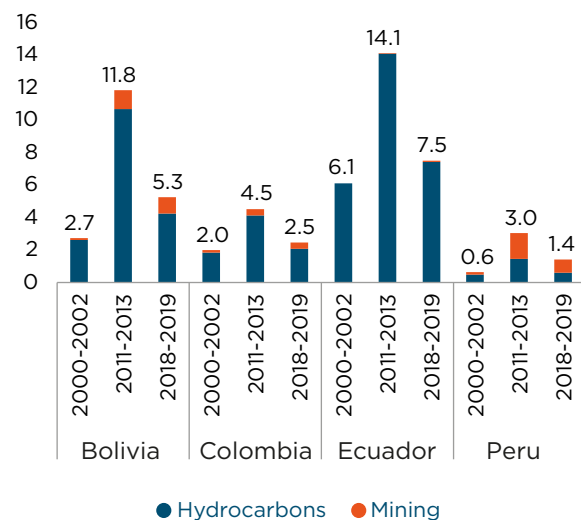
The performance of public finances in the Andean countries has been closely linked to the international price cycles of crude oil and minerals and metals. According to Andrián et al. (2020), the Andean countries share a common characteristic of low tax collection and a dependence on revenues derived from the exploitation of raw materials. For example, in Bolivia and Ecuador, tax revenue from hydrocarbons and mining came to represent over one-third of total fiscal revenues (Figure 3.1, left panel) and more than 10 percentage points of GDP (Figure 3.1, right panel). Thus, the amount of revenue has been influenced by the evolution of commodity prices (Andrián et al., 2022b). During periods of high prices (e.g., 2011–2013), revenue reached an average peak of 8.3% of GDP for the Andean Region (Figure 3.1, left panel), while during less-favorable times (e.g., 2018–2019), revenue only averaged 4.2% of GDP. Additionally, the relative weight of revenue from hydrocarbons stands out in Bolivia, Colombia, and Ecuador, while in Perú, revenue generated by mining predominates (see Andrián et al., 2023, for further details).

Figure 3.1. Tax revenues from the exploitation of nonrenewable resources by country and product, Andean Region

As percentages of total revenues, 2000-2019



As percentages of GDP, 2000-2019



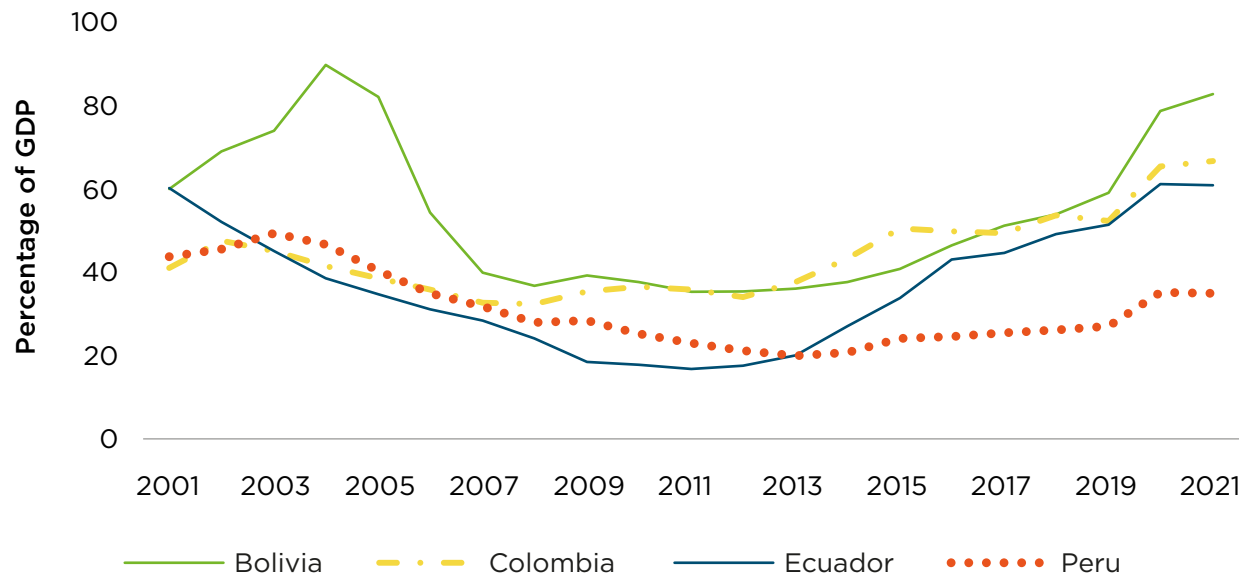
Source: Andrián et al. (forthcoming).

Furthermore, the countries in the region are characterized by a low tax burden and have some structural aspects that limit greater resource mobilization. Prior to the pandemic, tax revenues in the Andean countries averaged 17% of GDP, below the average for Latin America and the Caribbean (LAC) (19% of GDP) and OECD countries (26% of GDP). Among the factors explaining this lower performance are the limited role of direct taxes, tax bases with few contributors, numerous existing exemptions, and high levels of tax evasion and informality in the Andean economies (Andrián et al., 2020).

As for public expenditure, its behavior is characterized by a procyclical bias, with significant increases in current expenditure. Additionally, the inflexibility of spending did not allow for countercyclical fiscal policy management or a reduction in spending during the expansive phase of the economic cycle (Andrián et al., 2020). These realities led to a greater dependence of public finances on revenues from extractive resources.

When examining the behavior of revenues and expenditure, it is evident that debt was reduced only during the boom of the supercycle of commodity prices (Figure 3.2). Additionally, the need for additional resources to address the shock caused by the COVID-19 pandemic led to a significant increase in debt during 2020 and 2021 in the countries of the region (Figure 3.2). Although these increases in debt have occurred in a context of lower global interest rates, changes in global financing conditions could have significant negative consequences for countries with high levels of indebtedness (Rogoff, 2020; Cavallo et al., 2022).

Figure 3.2. Gross debt of Andean countries



Source: Own estimation based on World Economic Outlook (International Monetary Fund).

In light of the current situation, the countries in the region will have to deal with lower tax revenues resulting from the decarbonization process in the medium and long term. In this sense, having adequate fiscal institutions is of vital importance to maintain fiscal stability and continue addressing the development challenges that the region still faces. It is crucial for each country to understand the extent of the effects of the transition to decarbonization (Andrián & Álvarez, 2023). The limited availability of sector-specific studies on this topic makes informed decision-making difficult. Without precise knowledge of the impact, defining policies that align with their objectives becomes challenging, and countries are therefore confronted with the challenge of creating long-term strategies that align with their internal needs and circumstances. Different sectors and ministries need to collaborate closely and model various long-term decarbonization pathways. This will enable them to address the internal transformations of each sector during the decarbonization process and leverage potential benefits (Eguino & Delgado, 2023).

Despite being oil-exporting economies, the Andean countries allocate public funds to subsidize fuels, which puts some pressure on public finances. In 2022, this expenditure represented an average of 2% of GDP in Colombia, Bolivia, and Ecuador. Colombia has the Fuel Price Stabilization Fund (FEPC, from its acronym in Spanish), the mission of which is to ensure price stabilization that protects fuel consumers and producers in the country.¹ Subsidies help keep fuel prices relatively stable. However, there may be a point at which they become unsustainable and governments are forced to alleviate their finances by cutting subsidies; however, an increase in fuel prices can lead to public dissatisfaction and unrest (McCulloch et al., 2022). In a global decarbonization context where fossil fuel prices are falling, not only would tax revenues from oil rents decrease, but also the burden that subsidies impose on public finances would increase.



The countries of the region will face lower fiscal revenues from the decarbonization process in the medium and long term.

¹ This is achieved through the implementation of financial mechanisms that allow intervention in the fuel market and avoid drastic price fluctuations, providing a certain degree of predictability in the cost of fuels for citizens and transporters.

3.2 Institutional strengthening as a path to stability²

Fiscal rules aim to address the issue of temporal inconsistency in public finances and limit debt accumulation by setting limits on fiscal deficits. There is variation among countries in the region regarding fiscal rules (Table 3.1). In 2021, Colombia modified its fiscal rule.³ Key aspects of the new fiscal rule include (1) the incorporation of a debt rule through the inclusion of an anchor and a debt limit,⁴ and (2) the definition of targets for the structural net primary balance and the strengthening of the methodology for calculating it. Perú has a set of fiscal rules, including a fiscal balance rule and limits on debt, fiscal deficits, and expenditure growth.⁵ It's worth noting that the Peruvian fiscal rule imposes stricter growth limits on current expenditure while also safeguarding public investment (Izquierdo et al., 2018).^{6 7}

Colombia⁸ and Perú are the only countries in the region with independent fiscal councils, both of which have their own budgets, and their decisions are nonbinding.

Table 3.1. Fiscal rules in countries of the Andean Region

| Country | Expense rule | Balance rule | Debt rule | Income rule | Coverage | Escape clauses | Structural targets | Fiscal Council |
|----------|--------------|--------------|-----------|-------------|--------------------|----------------|--------------------|----------------|
| Colombia | | X | | | Central government | X | X | X |
| Ecuador | X | X | X | | Central government | X | | |
| Peru | X | X | X | | NFPS | X | | X |

Source: Based on Andrián et al. (2023).

- 2 For a more extensive discussion on macrofiscal institutions, see Andrián et al. (2022a).
- 3 The main shortcoming of the Colombian fiscal rule is that since its establishment, the fiscal authorities have always complied with the objectives established by the fiscal rule, but public debt has increased continuously since its implementation (Arbeláez et al., 2021). This behavior is partly explained by the cyclical adjustments (particularly in oil prices) allowed by the rule.
- 4 The debt limit (71% of GDP) is defined as the level of indebtedness above which substantial risks to the sustainability of public finances begin to be generated. The debt anchor (55% of GDP) is defined as the level to which the objective is to converge in the medium term.
- 5 According to De la Cruz et al. (2020), the debt rule establishes that the total gross debt of the NFPS should be less than or equal to 30% of GDP. The balance rule states that the NFPS annual fiscal deficit should be $\leq 1\%$ of GDP. The expenditure rule states that the annual real growth rate of general government primary spending should be less than or equal to the upper limit of the range of ± 1 p. p. of the 20-year average of real GDP growth.
- 6 Recent work finds that over the past few years there have been certain inconsistencies in the implementation of fiscal arrangements (Schmidt-Hebbel, 2022). As a first point, the existence of three simultaneous rules in the country could be restrictive and lead to coordination problems between different policy objectives. Second, the frequent changes in the coverage of the rule's application, the quantitative objectives, and the imposition of time limits or suspension in the rules could have generated credibility problems in the fiscal institutionality.
- 7 This is given by imposing a cap on current expenditure growth and at a minimum, investment grows at the same rate. See Andrián et al. [2023] for more details).
- 8 In the Colombian case, the modifications made in 2021 have raised the institutional quality of the fiscal council, for example, by giving it greater powers and budget (see Andrián et al., 2022a, and budget).

In the case of Ecuador, the new fiscal responsibility framework, which is still in the process of implementation, imposes a limit on expenditure growth and restricts the deficit, while reaffirming the goal of keeping the debt-to-GDP ratio below 40% in the medium and long terms.⁹ Finally, in Bolivia, there is no fiscal discipline rule for the execution of the public sector budget that ensures fiscal balance and guarantees the sustainability of public sector finances.

In all countries in the region, there are royalties, generally with scales of variable rates based on easily verifiable criteria, such as the level of production, location and depth of wells, the type of resource extracted, or another variable related to cost structure. Fiscal revenues from the exploitation of nonrenewable natural resources have been an important source of public resources, not only for central governments but also for subnational governments. The use of this particular tax base represented an improvement in the fiscal position of several subnational governments, especially those considered “producers” of such goods (Andrián et al., forthcoming). Royalty systems have had several significant unintended and unwanted effects: (1) an increase in inequality and fiscal disparities at the subnational level, (2) the exacerbation of budgetary volatility in subnational governments, and (3) deterioration in the efficiency of spending due to the low quality of public investments (Andrián et al., forthcoming).

Stabilization funds and the use of financial hedges can also be valuable tools to complement fiscal institutions in countries with high commodity-derived revenues. The main function of stabilization funds is to protect the public budget from commodity price volatility, allowing for the accumulation of resources during periods of high prices and the drawdown of resources when prices decrease, thereby smoothing the economic cycle. Financial hedges can also be a relevant tool to mitigate the impact of fluctuations in international commodity prices on the economy. These hedges reduce revenue volatility and can reduce sovereign debt risk differentials (Ma & Valencia, 2018).



Stabilization funds and the use of financial hedges can also be valuable tools to complement fiscal institutions in countries with high commodity-derived revenues.

⁹ The new system also incorporates some elements that could reduce fiscal procyclicality, such as the new stabilization fund or escape clauses to deal with extraordinary situations.

Table 3.2. Sovereign funds in countries of the Andean Region

| Country | Sovereign fund | Assets (2018) | |
|----------|--------------------------------|--------------------|-------|
| | | Dollars (billions) | % GDP |
| Colombia | Savings and Stabilization Fund | 3.1 | 0.9 |
| Peru | Fiscal Stabilization Fund | 5.8 | 2.6 |

Sources: Official reports and websites of sovereign wealth funds and World Economic Outlook database (INTERNATIONAL MONETARY FUND, April 2019).

The transparency of ultimate beneficiaries is considered one of the main tools to combat illicit financial flows related to corruption, money laundering, tax evasion, and terrorism financing, among many other problems. It involves identifying the natural persons who effectively and ultimately own or control companies (or other types of entities, such as trusts) operating in the economy.¹⁰

The current global trend toward transparency of ultimate beneficiaries is related to the concept used by the FATF in the Anti-Money Laundering and Combating the Financing of Terrorism (AML/CFT) Recommendations, which was later adopted by other international institutions, including the Global Forum on Transparency and Exchange of Information for Tax Purposes and the EITI.¹¹ Countries in the Andean Region show diversity in adopting EITI standards. Bolivia is not an EITI member and has no records of ultimate beneficiaries, Colombia and Perú are EITI members with recent laws and central registers of ultimate beneficiaries, and Ecuador joined EITI in 2020 and has public information on company ownership for certain cases.

Table 3.3. Categories of EITI Standard implementation progress

| Country | Category of progress |
|-----------|----------------------------------|
| Bolivia | Does not implement EITI standard |
| Colombia | Moderate / significant |
| Ecuador | Pending of assessment |
| Peru | Moderate / significant |
| Venezuela | Does not implement EITI standard |

Source: <https://eiti.org/es/paises>.¹²

Based on the information available in the mutual evaluation reports of the Financial Action Task Force of Latin America (GAFILAT, for its acronym in Spanish), the effectiveness ratings by immediate outcome in Colombia and Perú are as follows:

- ¹⁰ The concept of ultimate beneficiaries, also known as beneficial owner, holder, or real owner (also ultimate beneficial owner) can be confusing, because the same term (though with different meanings) is used in various legal frameworks, including double taxation treaties, financial regulation of publicly traded companies, and the Anglo-Saxon trust regime (the Trust).
- ¹¹ The EITI Standard requires implementing countries to request and companies to disclose information about ultimate beneficiaries (Requirement 2.5.c). This requirement applies to companies seeking to obtain or holding a stake in an oil, gas, or mining exploration or production contract or license. It requires them to disclose their ultimate beneficiaries (name, nationality, residence), their level of ownership, and details on how ownership or control is exercised. Politically exposed persons must also be identified.
- ¹² Retrieved from: <https://eiti.org/es/paises>.

Table 3.4. Effectiveness ratings by immediate result (IR)

| RI | País | |
|--|-------------|-------------|
| | Colombia | Peru |
| 1. Risk, policy and coordination | Substantial | Moderate |
| 2. International cooperation | Substantial | Substantial |
| 3. Monitoring | Moderate | Moderate |
| 4. Preventive measures | Moderate | Moderate |
| 5. Persons and legal structures | Moderate | Low |
| 6. Financial intelligence | Substantial | Substantial |
| 7. Investigation and prosecution of ML ¹³ | Low | Low |
| 8. Confiscation | Substantial | Moderate |
| 9. Investigation and prosecution of TF ¹⁴ | Low | Moderate |
| 10. TF preventive measures and financial sanctions | Moderate | Substantial |
| 11. Financial sanctions for FP ¹⁵ | Low | Substantial |

Source: GAFILAC (2019) and International Monetary Fund-GAFILAC (2018).¹⁶

The information about actors and ultimate beneficiaries should include the prior identification of these individuals. This applies to both national and foreign companies operating in the sector. Ideally, this information should be accessible and available to a wide range of stakeholders who may want to consult it at any time. Furthermore, it is important that this information is fully available to authorities worldwide. In this way, the general public, as well as journalists, researchers, and entities working against corruption, money laundering, and tax evasion, can monitor different financial transactions and identify suspicious trends, such as bribes passing through various fictitious transfers and noncommercial simulations that ultimately enable money laundering. Moreover, it is possible to prevent overpricing payments or other bribes from being accounted for as payments for services, potentially leading to tax evasion by the companies favored in the bidding processes through a reduction of the tax base.

The ideal scenario would be one in which there is an open data system that provides effective, online, and free access to the public or to as many directly and indirectly affected stakeholders as possible, as well as to those third parties who are simply interested in information about ultimate beneficiaries in the extractive sector.

While the EITI, FTAF, and the Global Forum all seek to promote transparency and accountability in different areas, each has a different focus. The EITI evaluates countries based on their compliance with the organization's standards and requirements for transparency and accountability in the extractive sector. To conduct these assessments, a validation process is used to determine whether countries meet the established standards. GAFI, on the other hand, rates countries based on their compliance with international standards for anti-money laundering and counterterrorism financing. This organization conducts an assessment of countries based on their legal framework, their capacity to investigate and

¹³ Money laundering.

¹⁴ Terrorism financing.

¹⁵ Financing the proliferation of weapons of mass destruction.

¹⁶ For more details, please review the Mutual Evaluation Reports of Colombia and Peru.

prosecute financial crimes, and their international cooperation in the fight against money laundering and terrorism financing. Lastly, the Global Forum monitors countries based on their compliance with international standards for tax transparency and information exchange, evaluating countries based on their ability to exchange tax information with other countries and promote transparency in their tax systems.

In summary, while these three organizations share similar goals of promoting transparency and accountability, they focus on different areas and use different methodologies to assess country compliance. Based on the information available for each country, these international bodies each generate a rating of transparency for each country, which can provide insights into the degree of compliance with the recommendations these organizations have made to countries in terms of transparency. However, the inconsistency between international organizations can distort or confuse the message conveyed to decision-makers. The difference lies in the lack of consistency between international organizations; for example, the timing of EITI, FATF, or the Global Forum analyses may differ or the results of the final ratings could be contradictory, making it more challenging to take specific actions (Knobel, forthcoming).

3.3 Improved fiscal institutions for a smooth transition

The availability of revenues from nonrenewable natural resources provides a short-term opportunity to generate higher fiscal income. However, in the medium and long terms, as the global decarbonization process continues, this dependency on natural resources will create a high degree of vulnerability and uncertainty about the adequacy of future budgetary resources, because a significant portion of these resources would become “stranded assets.” Thus, it is necessary for governments to design strategies to optimize the use of nonrenewable natural resources. On the one hand, if a country decides to phase out this industry faster than the pace at which the world is decarbonizing, it will be sacrificing oil revenue. On the other hand, the country is investing in an asset that will become “stranded” at a faster rate than the investment can be recovered. Therefore, it is advisable for domestic policies to be synchronized with the pace of global decarbonization. At the same time, it is essential to anticipate and promote the development of sustainable long-term alternatives. In this context, finding the right time to make use of available resources and ensure the continuity of income becomes essential, in light of the transition to a decarbonized future. Prioritizing a balance between responsible resource utilization and planning for a more sustainable and environmentally friendly future is crucial.

The challenge is to promote fiscal reforms that improve the fiscal position of national and subnational governments without compromising growth and tend to be progressive. De la Cruz et al. (2020) provide a menu of options for tax and expenditure reform at all levels. At the national level, there is room to increase revenue from direct taxes, particularly personal income tax, either by increasing rates progressively or eliminating exemptions and deductions. There is also room to reduce tax expenditures in the value-added tax (VAT) without harming the most vulnerable, such as “personalized” VAT (Barreix et al., 2012). Additionally, it is necessary to think about tax schemes that encourage formalization, such as negative income tax (Pessino & Alarcón, 2021).

Regarding expenditure, there is room for savings of up to 5% of GDP through an improvement in the quality of public goods and services provision (De la Cruz et al., 2020). Among other measures, there is room to improve public procurement, for example, through centralization and the use of a digital platform. Enhancing the targeting of subsidy and transfer programs to reach the most vulnerable population is

another possible measure.¹⁷ One of the essential aspects of implementing these reforms is the communication and dissemination of them to society to clearly establish public needs, the scope of the measures, and who the ultimate beneficiaries will be.

Although in theory, well-designed and applied fiscal rules can eliminate the cyclical bias in countries, empirical results show that this is not always the case (Caselli & Reynaud, 2020; Barbier-Gauchard et al., 2021; Debrun & Kumar, 2007; Heinemann et al., 2018). This lack of effectiveness is due to the inability of fiscal rules to perfectly anticipate exogenous shocks. Furthermore, the rules can be manipulated, because many of the objectives are based on assumptions projected on various macroeconomic variables, both local and global. In the case of the Andean countries, the effect of international commodity prices is particularly problematic when adequately projecting fiscal targets. This creates a wide margin of maneuver for governments, which can result in an efficiency loss in the applied fiscal rules (Wyplosz, 2012). Therefore, having fiscal rules is not sufficient to achieve the proposed fiscal objectives; they must be well designed and accompanied by high-quality fiscal institutions (Wyplosz, 2012; Eyraud et al., 2018; Caselli & Reynaud, 2020; Andrián et al., 2022a).

Although high-quality fiscal rules can help prevent excessive debt accumulation in the face of negative commodity price shocks, Andean countries must explore instruments to smooth their fiscal performance over time. According to Andrián et al. (2022b), hedging instruments can be a viable short-term strategy to mitigate the adverse effects of falling commodity prices. In particular, they suggest that put options can be used as protective instruments against declining commodity prices, thereby alleviating public debt and fiscal deficits. The use of stabilization funds or hedges (such as financial derivatives) can be complementary strategies. Stabilization funds require time to accumulate resources and are subject to governments' temptation to use those funds for purposes other than their original intention. On the other hand, the use of hedges can be costly and politically challenging in terms of acceptance by other branches of government, because their benefits are only realized when they are executed in an adverse shock.

Despite the energy diversification being pursued by the Andean countries, it is clear that alternative energy sources will not generate resources to the same extent as the traditional hydrocarbon sector, primarily because the alternative energy sources are not generating any royalties. As royalties are the most significant contribution received by subnational governments and serve as a territorial development tool, the shock will be felt through a reduction in high-impact projects in producing departments and, consequently, nations' revenue from this industry. This analysis does not even delve into or thoroughly study the impact that the closure of oil fields and mines in some regions, where the economy depends largely on the industry, might have (Andrián et al., forthcoming).¹⁸

While there are significant potential benefits from the energy transition in the region, actual production depends on environmental, social, and governance factors specific to each country that must be managed properly to ensure sustainable development (Unzueta et al., 2022). It's also worth considering the challenges related to the availability of so-called "critical minerals" in the region and the supply-demand



The challenge is to promote fiscal reforms that enhance the fiscal position of national and subnational governments without compromising growth and tend to be progressive.

¹⁷ For more information, see Izquierdo et al. (2018).

¹⁸ For a more detailed discussion of the recommendations by country, see Andrián et al. (2023).

imbalances that could arise in the medium term (IEA, 2021). Moreover, the degree of dependency on revenues from the hydrocarbon and mining industries varies from one economy to another. Therefore, gradual phasing-out could result in a stock of stranded assets with different impacts not only among Andean countries but also within economies. This can lead to, among other things, labor market effects, such as job losses in these sectors, creating adverse distributional effects for the population (Hancevic et al., 2023).

The debate over the contribution of extractive industries to public finances should consider the regions and prepare them for economic diversification to mitigate potential socio-environmental effects in case projects must close or reserves run out. Furthermore, royalty systems should be reformed to improve territorial equity, reducing subnational income volatility and promoting resource-efficient use.

Finally, taking measures that impose economic consequences for noncompliance or ensuring that beneficial ownership information is easily accessible to civil entities and journalists, among other measures (Knobel, forthcoming), can be critical to overcoming obstacles that hinder transparency and allow for additional benefits for the government and society. For instance, it would enhance tax collection and reduce money laundering by identifying the ultimate beneficiaries of extractive industries' exploitation. It would also prevent corruption and improve the quality of concession and exploitation contracts, increasing public revenues and improving socio-environmental conditions at extraction sites by identifying the parties ultimately responsible for the contracts. Lastly, it would generate transparent information for the entire society about those who benefit from extractive resources.

4



PRODUCTIVE CHAINS

4. LEVERAGE THE SECTOR'S CONNECTIONS

4.1 A sector that is not an enclave

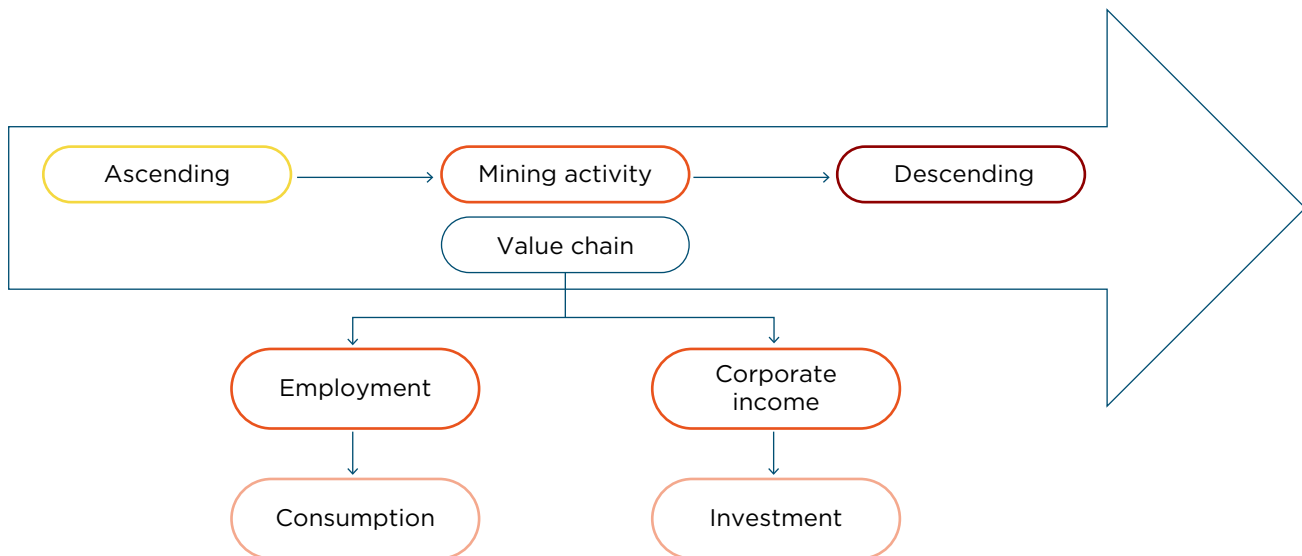
As we have stated, to fully harness the potential of natural resources, it is necessary to adopt a comprehensive approach that promotes productive linkages in the extractive sector. Productive linkages refer to the interactions between different sectors of the economy, where the production of one sector has an impact on the performance of other sectors (Correa, 2016).

Productive linkages in the extractive industries involve different actors and activities along the value chain. For example, the exploration and extraction of resources may require specialized services from engineering companies, drilling, and geological services. In turn, the processing and transformation of resources may involve refining, smelting, or manufacturing companies. Furthermore, the transportation and marketing of the extracted products also involve the participation of logistics, transportation, and marketing companies. These linkages can generate positive productive externalities and multiplier effects in other related industries, such as construction, manufacturing, or service provision. However, there can also be negative externalities and effects, such as environmental degradation, social conflicts, and excessive economic dependence on the extractive sector, as mentioned in previous chapters.

In the case of the mining sector, an increase in production results in higher taxes and royalties, which in turn has an impact on government revenue generation and public expenditure financing. It is also important to distinguish between upward and downward linkages. Upward linkages refer to the relationships established with suppliers and services that provide inputs and equipment necessary for mining activities, such as specialized machinery. Downward linkages, on the other hand, are related to “value-added” and their connection with industries that use the extracted minerals, such as the metallurgical, construction, and manufacturing industries (Ministry of Mines and Energy of Colombia, et al.¹ 2019).

These intersectoral connections play a crucial role in job creation and the promotion of consumption, as well as the generation of associated taxes. An increase in production generates a higher demand for employment—both in the mining sector and in other industries—which, in turn, increases the purchasing power of workers. Additionally, mining company revenues can be reinvested in infrastructure, technology, and training (Almaguer, 2007), all of which contribute to the development of the local community and the overall regional economy.

¹ CCSI refers to the Columbia Center on Sustainable Investment.

Picture 4.1. Productive chains of the mining sector

Source: Adapted from Ministry of Mines and Energy of Colombia et al. (2019) and IPE (2021).

In the context of the Andean Region, the mining industry shows significant connections with other industries, although there are still opportunities to expand and strengthen productive linkages. A notable example is Perú, a country renowned for its mining industry. According to IPE (2021), in 2017 an increase of S/1,000 million in exports generated a total added value of S/1,464 million. Of this total, approximately S/630 million were directly generated in the mining sector, while around S/240 million were indirectly derived from input-supplying sectors. This added value has implications for workers' salaries and corporate profits, in turn driving consumption (S/170 million) and investment (S/424 million). On the other hand, it is estimated that imports related to mining exports have an effect of approximately S/400 million for every S/1,000 million of exports, of which approximately S/130 million are associated with direct and indirect effects during the production phase.

Regarding taxes, it is estimated that an increase of S/1,000 million in exports would generate approximately S/240 million in taxes and contributions, of which around S/82 million would be collected in the mining sector and the rest in other sectors. In terms of job creation, an increase of S/1,000 million in mining exports could lead to the creation of 21,019 jobs throughout the economy, taking into account both direct and indirect effects in other sectors, especially in land transportation (IPE, 2021).

Another interesting effect to observe is the significant increase in migration to mining-producing districts compared to nonproducing districts within mining regions. Immigrants arriving in the mining districts, on average, have higher levels of education compared to residents of other districts and the native population of these districts (Bustamante, forthcoming). This can contribute to the creation of high-quality jobs and strengthen the productive capacity of the region.

Table 4.1. Multiplier effect per S/1.000 million of mining exports in Perú, 2017 (current soles, millions)

| GROSS VALUE ADDED (GVA) | |
|-------------------------------------|----------|
| Effect on GVA | S/ 1,464 |
| Domestic production | S/ 870 |
| Domestic consumption | S/ 170 |
| Domestic investment | S/ 424 |
| TAXES | |
| Effect on taxes | S/ 240.7 |
| Taxes in mining ² | S/ 82.1 |
| Taxes in other sectors ³ | S/ 158.6 |
| IMPORTS | |
| Effect on imports | S/ 400 |
| Imported inputs | S/ 130 |
| Imported consumption | S/ 57 |
| Imported investment | S/ 213 |

Source: IPE (2021).

However, these linkages are not limited to Perú, as they are observed in other countries within the region. In Bolivia, for instance, the mineral production value experienced a 7.5% increase, and mining exports grew by 13.3% between 2021 and 2022. This growth was reflected in a 3.1% increase in mining royalties (Villavicencio et al., 2023).

In terms of job creation, the International Trade Centre and the International Labour Organization (2019) point out that every increase of USD 1,000,000 in mineral and derivative exports can have a significant impact on employment, estimating that it can generate up to 363 new jobs.⁴ However, it's worth noting that the export of other products such as cereals, fruits, meat, and legumes has a higher potential for job creation.

On the other hand, in Colombia, according to the Ministry of Mines and Energy (Ministerio de Energía y Minas, 2022), the mining and energy sector in 2020 generated revenues exceeding USD 14 trillion in taxes, dividends, and other compensations. It also facilitated the creation of over 2,000 jobs in 2020. Meanwhile, in Ecuador, between January and September 2022 the investment in mines and mining projects amounted to USD 133.9 million, leading to the accumulation of taxes and royalties and the creation of a total of 30,964 jobs, with 7,741 of them being direct jobs and 23,223 being indirect jobs (Banco Central del Ecuador, 2023).

For the oil and gas sector, productive linkages can also be observed at each stage of the value chain, from exploration to production. During the exploration stage, specialized services in geology, geophysics, and drilling are needed, creating a demand for inputs and services from companies specializing in these

² According to the Peruvian Institute of Economics (IPE, 2021), this concept includes 3rd, 4th, and 5th category income taxes, social contributions, royalties, Special Mining Tax (IEM, for its acronym in Spanish) and Special Mining Charges (GEM, for its acronym in Spanish).

³ According to the Peruvian Institute of Economics (IPE, 2021), this concept includes indirect taxes (IGV and ISC) and 3rd, 4th, and 5th category income taxes as well as social contributions from other sectors related to mining.

⁴ These jobs are generated not only directly in the mining industry, but in related sectors as well.

areas. As the project progresses to the development stage, more equipment and services are required for building infrastructure, such as drilling platforms, pipelines, and storage facilities. This drives the demand for related goods and services, such as steel, machinery, transportation, and engineering services. Both stages are characterized by specialization and a relatively low demand for unskilled labor, limiting local content. However, in the production stage, continuous inputs such as energy and water are required, as well as maintenance and logistics services. In this stage, more opportunities may arise for local companies, because the necessary inputs can be less specialized (Tordo et al., 2013).

According to Tordo et al. (2013), in most countries the oil and gas sector exhibits fewer upward linkages compared to other industries but shows numerous downward linkages. Specifically, in the Andean Region, Bolivia and Ecuador stand out for having some of the highest levels of direct and indirect forward linkages in this sector compared to other sectors of the economy. However, by 2007, it was observed that in countries like Venezuela, Ecuador, Bolivia, and Perú the gas and oil sector had very low backward linkages compared to other industries.

In addition to the mentioned aspects, the development of transportation and energy infrastructure⁵ is crucial for driving projects in the mining and hydrocarbon sectors and can also have positive effects on other industries. This infrastructure plays an essential role in meeting logistical needs, facilitating the transportation of personnel and inputs, providing electricity, and ensuring efficient transportation of mineral and hydrocarbon products to markets. Furthermore, this development can have favorable impacts on sectors such as livestock, agro-industry, and trade in general while also improving people's mobility, providing greater speed and safety in their movements (Consortio BDO & LQG Energy and Mining Consulting, 2021).

The data presented support and highlight the economic potential of the sector in the Andean Region, generating benefits at both the national and regional levels. The expansion of natural resource production and exports is not only strengthening the economy, it is also promoting job creation, thus fostering economic and social development in the region. However, it is crucial to recognize that this growth poses challenges that need to be effectively addressed, such as associated negative externalities and limited relationships with certain sectors. To address these challenges, it is necessary to adopt a comprehensive approach that promotes responsible and sustainable practices in the sector, enabling the full economic potential of the Andean Region to be realized.



The sector in the Andean Region has the potential to generate benefits both nationally and regionally.

⁵ Such as roads, highways, ports, railroads, airports, mining pipelines, and transmission lines and oil pipelines.

4.2 A region that does not take advantage of the chains to its natural resources

Despite the existing links between the mining and hydrocarbon sectors and other industries, there is limited integration and low cooperation in productive chains, especially in the more-specialized stages of the value chain. This situation presents significant challenges for the maximizing of the economic and social benefits that could result from greater interaction between the extractive sector and other productive sectors.

Regarding upward linkages, the full potential in the value chain of the extractive sector has not been reached. Significant dependence on the import of goods and services, as well as the need for highly skilled personnel, hinders the integration and the development of local suppliers. Additionally, there are very few policies in place aimed at strengthening these linkages.

A clear example of this situation can be observed in Colombia. According to Dufey et al. (2023a), the metallic mining and hydrocarbon sector lacks local linkages, as purchases from local suppliers represent less than 30% of the total. In terms of human capital development, there are no specialized training facilities for highly technological mining machinery. Furthermore, the lack of investment in research, development, and innovation for mining, coupled with deficient road and transportation infrastructure, limits job creation and the creation of intersectoral links.

A similar situation is present in Ecuador, where there is low development of suppliers in the mining sector. Despite the existence of the Amazonian law, which establishes quotas for local purchases, its impact is limited. On the other hand, the number of national suppliers is small and limited to routine and simple activities. In terms of human capital development, training programs show little activity, and there is a delay in the adoption of new technologies (Dufey et al., 2023b).

In Perú, on the other hand, the local supply chain is mostly controlled by foreign companies, while the participation of Peruvian suppliers in the supply of high-value-added inputs is limited (Bamber & Fernández-Stark, 2021). This situation reveals insufficient development of the capabilities of local companies. To achieve the successful integration of local suppliers into the chain, policies that promote training, research, and innovation development are required. However, the Peruvian innovation system still has significant deficiencies, limiting the growth and development of these suppliers in the sector.

In this regard, one of the most significant challenges in the sector is related to the development and strengthening of small national suppliers. According to Tordo et al. (2013), these suppliers face initial difficulties in competing with their international counterparts due to the economies of scale present in the production of certain inputs. In the short term, it is challenging for local companies to reduce their production costs and compete on an equal footing. These challenges are compounded by the shortage of human capital and the lack of investment in innovation, further limiting the capacity of local companies to compete effectively in the market (Bamber & Fernández-Stark, 2021).



The region shows limited integration and low cooperation in productive chains.

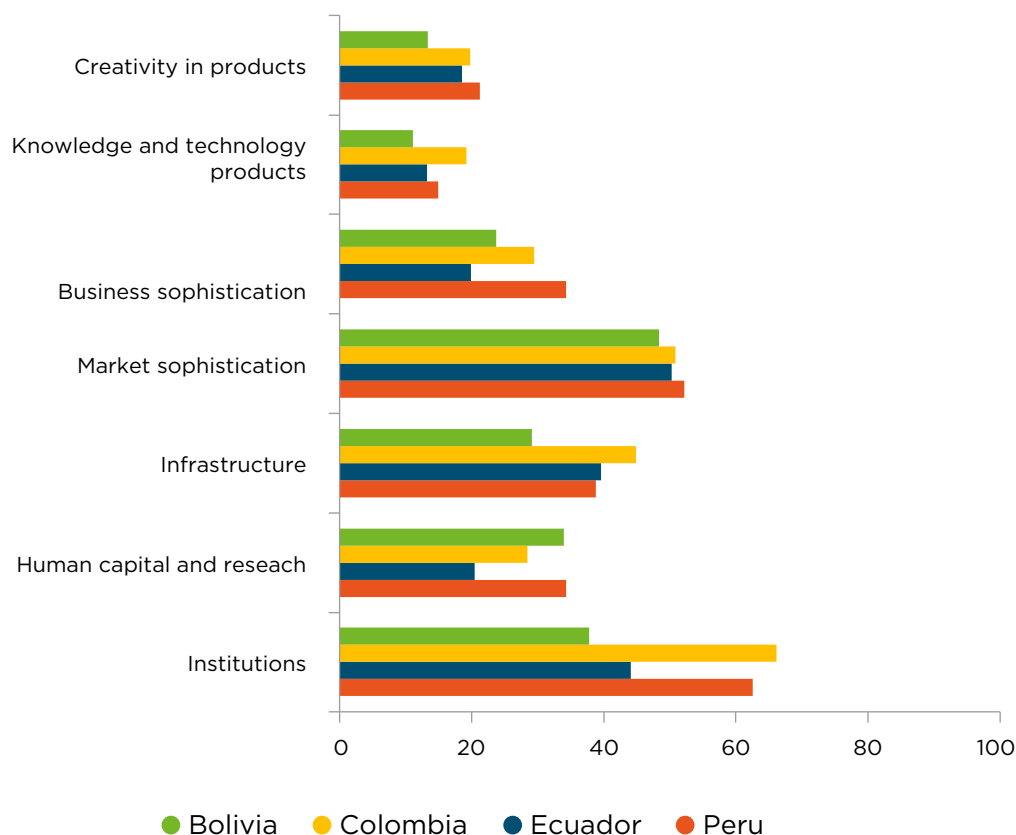


Additionally, countries have a low capacity for innovation, as shown in Table 4.2. Colombia, the country with the highest index, is ranked 63 out of 132 countries. While, as mentioned above, the lack of adequate financial and technological resources hinders the adoption of innovative practices and the development of new products and services by local suppliers, as seen in Figure 4.1, there are still issues related to creativity and sophistication in the development of these products. These limitations also have a negative impact on the quality and efficiency of the products and services offered by national suppliers. The lack of training and skill development among employees affects the quality of available human capital, which can result in lower productivity and competitiveness compared to more-established international suppliers.

Table 4.2. Innovation index 2021 (score between 0 and 100)

| COUNTRY | GLOBAL INDEX |
|----------|--------------|
| Bolivia | 23.4 |
| Colombia | 31.7 |
| Ecuador | 25.4 |
| Peru | 31.2 |

Source: World Intellectual Property Organization (WIPO, 2021).

Figure 4.1. Innovation index 2021 by pillar (score between 0 and 100)

Source: Prepared by the authors with data from WIPO (2021).

Another challenge observed in the development of effective productive chains is the tendency of countries to primarily focus on the extraction of natural resources without generating significant added value. According to FEDESARROLLO (2018), mining and quarrying activities make a minimal contribution to the departmental value-added in the Andean Region. Despite having an abundance of valuable resources, countries tend to be largely limited to the exploration and extraction stages of these resources. The lack of investment in technology, infrastructure, productive capabilities, and the limited diversification of the economy have contributed to the region's not fully capitalizing on the economic potential of its resources to generate greater economic value. Instead, there is a heavy reliance on the export of unprocessed raw materials, leading to lower creation of quality employment and less of a boost to the region's industrial and technological development.

An example of this situation is Perú, which stands out as one of the world's leading producers and exporters of copper. Despite having significant copper deposits, the country's primary focus is on the production of unprocessed copper minerals and concentrates, unlike countries like Chile and Mexico. In 2018, Perú, along with Indonesia and Mongolia, represented less than 2% of the world's copper-refining capacity (Bamber & Fernández-Stark, 2021).

Bolivia also faces barriers in adding value. According to Jones et al. (2021b), there is an expected increase in demand for lithium batteries in the next ten years. Despite being the world's leading lithium holder in 2023, Bolivia still faces limitations in developing the value chain for batteries, preventing the

creation of products with higher added value. Among the factors contributing to these limitations are the lack of infrastructure and facilities required to carry out large-scale production of refined raw materials, precursors, cathodes, cells, and battery assembly. Additionally, there are other obstacles to the development of new value-added products, such as the high specialization of processes and the lack of adequate fiscal and regulatory support (Jones et al., 2021a).

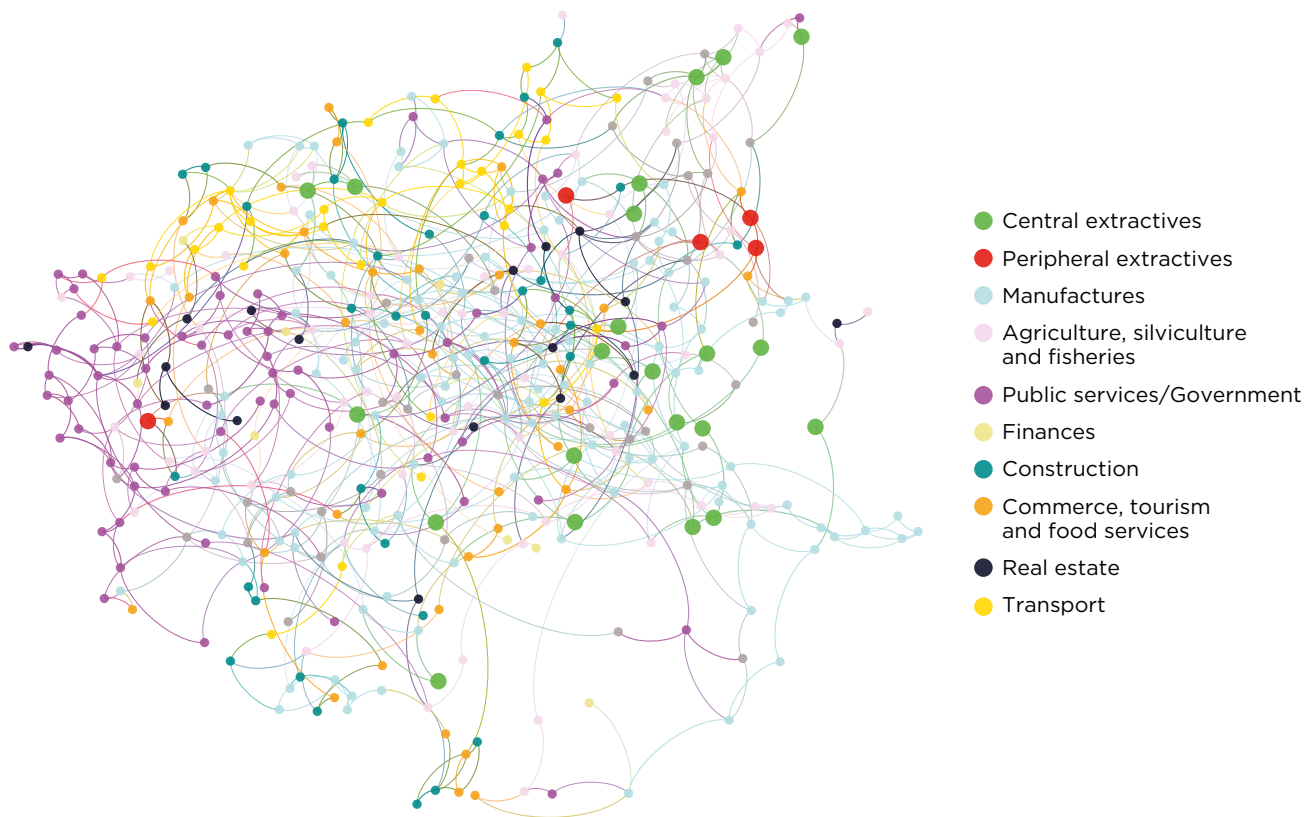
It is also important to highlight the effects and externalities associated with extractive activities. While the extractive sector can have positive impacts on economic development, it also presents significant challenges related to human capital accumulation, education, health, and the environment.

In the labor market, the extractive sector has considerable potential for generating employment opportunities, especially for economic activities that do not require professional workers, such as construction and retail (Marchand, 2012). In the specific case of Ecuador, it has been observed that investments in large-scale mining projects, such as Fruta del Norte, have had a positive impact by boosting local economic activity, resulting in increased economic dynamism and employment at the local level (Carrillo-Maldonado et al., 2023). This is also reflected in the petroleum sector, suggesting the possibility of long-term employment and local development (Acuña et al., 2022).

Zambrano et al. (2022) found that in Venezuela, residents of municipalities benefiting from natural resources tend to receive higher formal education and have a greater probability of accessing higher education, which has a positive impact on poverty reduction in terms of income. On the other hand, in Colombia positive effects are observed in primary and secondary school enrollment when examining the impact of royalties following the 2012 reform (Ome & Pérez, 2022).

Additionally, the sector generates knowledge that is transferred to other sectors. Balza et al. (2021a) use social security data in Colombia to study the displacement of workers in the sector. In other words, if a mining worker moves to a metal-mechanic company, a relationship is generated between the two activities. Figure 4.2 presents the space of productive activities using a measure of skill similarity based on the number of relationships between activities.⁶ The colors indicate the general economic category (GEC) of each node.

⁶ For each node, only the connections to the three nodes with the highest relationships are shown. Because the data used are from the entire social security database, the reader may realize that there may be links between sectors that do not have to be extractive. For example, a bank worker may go to work for a digital services company. These linkages do not include the extractive sector. In the graph, we have excluded the time of connection. Only clusters of activities that contain at least one extractive industry are shown.

Figure 4.2. The productive space and the extractive sector in Colombia

Source: Balza et al. (2021a).

It is evident that, in terms of skills, the extractive sector is connected to other economic activities. Specifically, extractive industries have closer links with manufacturing and agriculture than with other sectors. Therefore, it is important to understand the impacts of the knowledge transferred through workers in the extractive sector. Finally, Balza et al. (2021a) find that a stronger relationship with extractive activities is correlated with lower employment levels, particularly in capital-intensive sectors and with lower female employment. This may be related to what Itriago (2023) finds regarding women's access to technical education in the Andean Region.

Finally, the extractive industry also requires infrastructure, and this infrastructure can have positive effects for its users. Maldonado and Manzano (forthcoming) estimate the impact that roads built near extractive projects can have compared to those built in areas without extractive activity on variables such as employment and income. The authors find that, depending on the context, there are greater positive impacts of roads near extractive projects.

However, the extractive industry can also have negative effects. Excessive dependence on natural resources can redefine local economic dynamics and influence incentives for youth labor force participation. In this regard, some young people may be encouraged to enter the labor market instead of continuing their education, anticipating greater benefits from the opportunities generated by the extractive sector (Carrillo-Maldonado et al., 2023). This can result in a decrease in school enrollment,

especially at higher levels of education (Balza et al., 2021b). Furthermore, according to Ome and Pérez (2022), the lack of investment in improving educational quality can lead to the generated revenues from natural resources not having clear benefits in academic performance. In addition, there is ample evidence supporting the idea that wages and household earnings in areas dependent on natural resources can experience a significant decline in response to a commodity price crisis. A recent study by Parra-Cely and Zanoni (2022) has highlighted this phenomenon in the petroleum sector, revealing how the economy of this region has become particularly vulnerable to external shocks.

It is worth noting that the mixed effects described above are largely the result of the lack of effective public policies addressing the negative social externalities associated with extractive activity. Furthermore, excessive dependence on a natural-resource-based economy also poses significant challenges. To address these difficulties, it is of vital importance to implement effective policies that regulate and control extractive activity, promoting the mitigation of negative externalities and the adoption of sustainable practices.

4.3 Fostering innovation and technology allows for the development of local suppliers and the accumulation of human capital

The integration of the extractive sector at the local level poses a crucial challenge for promoting sustainable and equitable economic development. This holds true whether a diversification strategy in a context of resource abundance or a transition strategy due to a shift in economic activities is considered. The Scandinavian experience, in the midst of the commodities export boom, suggests that after natural resources are depleted, companies within these value chains can become globally competitive in their respective sectors (Blomström & Kokko, 2007). Dahlbeck and Gärtner (2019) document a similar trend in the transition to a coal-free economy in the Ruhr Valley. Leveraging existing capabilities was key to this transition.

As mentioned in Chapter 1, these policies must exist within a suitable institutional framework. In other words, isolated policies to harness value chains and logistics corridors are not sufficient (Hernández, forthcoming). This institutional environment has two important elements. Firstly, there must be an environment conducive to the development of high-quality and sustainable extractive activities. As argued by Dufey et al. (2023a, 2023b), in the case of mining in Colombia and Ecuador, despite recent institutional strengthening there are still several opportunities for improvement to drive sustainable mining. Secondly, it is crucial to have an adequate business environment for entrepreneurial development. As highlighted by De la Cruz et al. (2020), there are significant gaps in the Andean countries. Additionally, there may be an interrelation between these two variables; Gao et al. (2023) found that in Chinese cities where the extractive sector is a monopoly, innovation in nonextractive companies is lower. Therefore, the institutional environment must be seen as a whole.

As seen in Chapter 3, fiscal matters cannot be ignored. A productive transition will involve a rearrangement of fiscal revenues. Policies to harness value chains will also entail adjustments to fiscal programs. Hence, it is essential to consider this as a comprehensive approach to ensure that fiscal balances are maintained over time.

Similarly, as discussed in Chapter 2, these strategies are essential for gaining social acceptance. As emphasized by Bustamante (forthcoming), territorial development is a necessary component of mining activities. An example in the context of territorial development with a shared value approach is supporting

local businesses. While supporting local businesses may require investment, such investment generates profitability because these local companies could subsequently become suppliers to the mining unit. Sometimes these investments are not substantial. The author provides a successful example in Perú where a mining company trained local entrepreneurs in the transportation sector who were later included in the value chain of mining activities. This also underscores the importance of the private sector in this transition.

In this context, it is crucial to implement long-term policies and strategies that promote the integration of local suppliers into the supply chain of the extractive sector. Support should be provided to enhance local capabilities, reindustrialize, and strengthen the local economy. The case of the Ruhr Valley offers relevant lessons, as several initiatives aimed at guiding the transition from the federal level were not successful (Dahlbeck & Gärtner, 2019). It is also advisable to focus on the development of areas with outstanding competitive potential. This involves providing support and strengthening local businesses and facilitating their access to financing, as well as providing training and assistance in organizational and technical requirements.⁷ The goal is to improve their competitiveness and capacity to meet the demands of the extractive sector (Bamber & Fernández-Stark, 2021).

According to Wright (1999), the success of the United States in the mining industry was primarily based on a phenomenon of “collective learning,” where intellectual networks of mining universities connected with both government and private research. These characteristics are also crucial to Australia’s current success, but unfortunately they are absent in lagging countries. Therefore, it is necessary to promote research and the development of local technology as an integral part of value chain policies. This involves making investments in generating scientific and technological knowledge in the Andean Region, fostering collaboration between both private and public actors and facilitating the transfer of technology from extractive companies to local suppliers. In this way, the innovation capacity of local companies will be improved, generating greater added value in the region and effectively leveraging the resources and opportunities offered by the extractive industry.

On the other hand, it is necessary to strategically harness the positive externalities of the sector to boost the socio-economic development of local communities. For example, one of these externalities is the increase in income generated by extractive activities, which provides a unique opportunity to invest in improving the quality of education. Acuña et al. (2022) emphasize the importance of directing the increased income and higher public spending resulting from natural-resource extraction toward the education of students in resource-rich areas. In this regard, teacher training, access to educational materials, and the implementation of innovative educational programs that can have a greater impact on community education are required. In this way, human capital development can be promoted, creating more employment opportunities and laying the foundation for long-term sustainable economic growth.

⁷ According to Bamber & Fernández-Stark (2021), technical training related to global certifications in quality, health, and safety; procurement processes; and export procedures, among other topics, is required.



It is essential for government authorities, extractive companies, and educational institutions to collaborate in defining strategies and policies that drive quality education aligned with industry needs and societal expectations. For example, the establishment of training programs and scholarships could be considered; likewise, the promotion of applied research could enable effective knowledge transfer between the academic and business sectors.

For the positive externalities of the sector to translate into tangible improvements in education, a comprehensive and long-term vision is required. In addition to the abovementioned policies, it is crucial to invest in modern educational and technological infrastructure, regularly update curricula to reflect industry advancements, and promote inclusive and accessible education, thus ensuring equal opportunities for all individuals to access quality education. As emphasized by Blomström and Kokko (2007), the establishment of technical tertiary educational institutions in various Swedish cities as well as vocational schools was instrumental in Sweden's transformation from a natural-resource-based economy to a technology-driven economy.

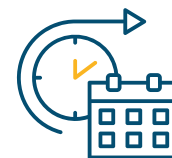
In line with these efforts, Bamber and Fernández-Stark (2021) emphasize the importance of local universities' being prepared to conduct industry-applied research and having the necessary infrastructure for it. This close connection between academia and the productive sector will generate relevant knowledge and innovative solutions in both the theoretical and practical domains, thus driving economic and technological development in the region. By strengthening this collaboration, the formation of highly skilled professionals equipped to face the challenges and opportunities of today's business environment will be promoted, positioning the region better for international competition.

It is also relevant to highlight the importance of effectively addressing the negative externalities that may arise in the extractive sector, as these can negatively impact access to education. A clear example of this is the increased opportunity cost of education. To address this challenge, it is crucial to implement strategies that not only mitigate negative externalities, but also promote the acquisition of human capital by young people. According to Carrillo-Maldonado et al. (2023), an alternative would be the implementation of profitable youth employment programs. These programs would provide young people with the opportunity to gain experience and skills while employed, facilitating their productive integration into the extractive industry and related sectors.

These programs must focus not only on providing employment to young people, but also on offering them comprehensive training that includes technical skills and transferable skills. This ensures that young people acquire a valuable set of competencies that diversify their employment options and increase their long-term employability. Additionally, it is essential to establish monitoring and evaluation mechanisms to measure the impact of these programs and make necessary adjustments for continuous improvement. This will ensure that the resources invested in these programs are used efficiently and effectively, maximizing the benefits for young people and society as a whole.

In terms of the environmental aspect, it is essential to recognize that this is occurring in the context of a global decarbonization phenomenon. Therefore, companies must begin the formalization of programs associated with quantifying their emissions based on globally accepted protocols. Likewise, efforts must be expanded and strengthened in the development of bio-inputs, waste management, recycling, and the circular economy. As highlighted by Clemente (forthcoming), in the case of the petrochemical sector, current efforts in this area are relatively modest in terms of their scope and maturity levels.

Finally, it is important to note that these measures require a long-term focus. As mentioned earlier, strategic planning and coordination among different stakeholders⁸ are needed to establish a solid foundation for sustainable improvement, the utilization of positive externalities from the extractive sector, and the reduction of negative externalities. In addition to this, Arora and Schroeder (2022) emphasize the importance of researching and monitoring the impact of implemented policies and actions. This can enable the adjustment of strategies and policies in accordance with each country's context, thus improving the participation of local suppliers, maximizing value-added in the region, and effectively managing the productive externalities of the industry.



Developing local suppliers and building human capital requires a long-term approach.

⁸ Such as government, the private sector, and academic institutions.



DIGITALIZATION

5. INTRODUCING THE SECTOR INTO A DIGITAL ECOSYSTEM¹

5.1 Digitalization brings economic, environmental, and social benefits to the extractive industry

The extractive industry is capital-intensive, which has driven its reliance on technological advancements. However, today technology has become even more critical, due to global efforts to achieve the climate goals set out in the Paris Agreement. These climate targets, aimed at mitigating the environmental impact of the global production system, present a series of challenges and opportunities. With the anticipated significant increase in demand for cleaner fuels and essential metals and minerals for green technologies, the extractive industries face unprecedented pressure to transform their operations.

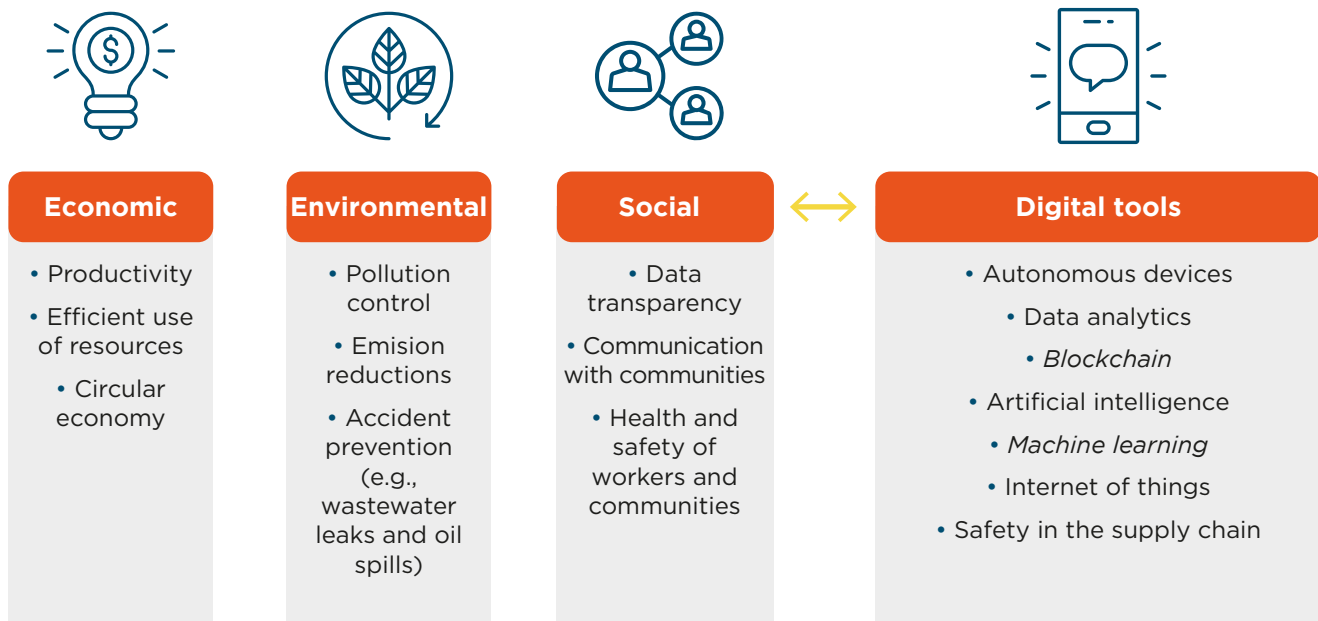
In this context, digitalization emerges as a key catalyst to address the challenges of the energy transition. The effective incorporation of disruptive digital technologies, such as artificial intelligence (AI), blockchain, the Internet of Things (IoT), and big data analytics, not only provides a competitive advantage, but also opens the door to more-sustainable and efficient production. However, these digital technologies also bring new challenges to consider, such as increased vulnerability to cyberattacks, technological unemployment, and the lag in legislation regarding technology.

The most widely adopted technologies in the Andean Region are data analytics and blockchain, which are being used by both public and private organizations. However, there is still ample room for the industry to benefit from the greater adoption of other technological tools that are currently being used in a fledgling manner, such as autonomous devices and supply chain security. Similarly, there is significant potential for the adoption of technologies such as AI, machine learning, and IoT that are further behind. The advantages of adopting digital technologies can be framed within three dimensions: economic, environmental, and social. Figure 5.1, based on a Carbon Trust study (2022), highlights specific applications of emerging technologies in extractive projects in the Andean Region, categorized according to these dimensions. The adoption and diffusion of digital technologies have become a necessity for companies to address current challenges within each of these dimensions.



Digitalization emerges as a key catalyst to address the challenges of the energy transition.

¹ This chapter is mainly based on the study conducted by the Carbon Trust which can be found at the following link: <https://publications.iadb.org/en/digitalization-extractive-sector-comparative-analysis-andean-region>.

Gráfico 5.1. Digitalization drivers for the extractive industries sector in the Andean Region

Source: Adapted from Carbon Trust (2022).

In the economic domain, digital technologies have the potential to significantly revolutionize the industry's productivity. According to a report by Ericsson (2020), the adoption of technologies such as autonomous vehicles, remote-controlled drilling, unmanned drone inspections, intelligent ventilation control, and real-time monitoring could increase mining project productivity by up to 60%. However, these technologies require private cellular networks with fifth-generation (5G) mobile network capabilities, providing high-speed and high-performance connectivity, especially in high-density device environments.

In the environmental domain, digital technologies, such as data systems and sensors, can play a crucial role in pollution control, reducing CO₂ emissions, and preventing environmental accidents, such as oil spills and wastewater leaks (Carbon Trust, 2022). In addition to protecting the environment, process automation also improves occupational safety by reducing the number of employees working in the most hazardous areas of extractive projects.

It is also important to highlight that there is a growing demand for sustainable investments based on environmental, social, and governance (ESG) criteria worldwide. In response to this trend, the extractive sector has begun to reconsider not only its internal operations, but also how it interacts with local communities, areas of influence, the environment, and public opinion. Transparent and effective communication regarding performance in these three dimensions has become a vital element for a successful and sustainable corporate strategy (Carbon Trust, 2022).

One of the most pressing challenges facing the extractive industry is ensuring transparency and traceability regarding sustainability and social impact. The application of blockchain technology has emerged as a powerful tool both internationally and in the Andean Region to meet these objectives. Through blockchain, it is possible to trace minerals and metals from the point of initial extraction to the sale of the final product, verifying compliance with required sustainability standards. This is particularly

relevant due to the increasing concern among electric vehicle manufacturers, who seek to include materials in their production that are extracted with minimal environmental impact.

The IDB has led the *MapaInversiones* initiative,² funded by the Transparency Fund (AAF) and with the technological support and backing of Microsoft, by applying analytical tools and cloud services. This initiative aims to promote transparency in public spending, investments, and procurement in LAC across various sectors, including the extractive sector. Balza et al. (forthcoming, d), examine the type of information available on such platforms that motivates citizen engagement in the oversight of mining projects. The study employed an online experiment with participants from Bolivia, Colombia, Ecuador, and Perú and presented different sets of information to control and treatment groups. One of the treatment groups received a specific message designed based on behavioral science with the aim of evaluating whether an increase in individuals' sense of self-efficacy leads to greater participation.³

From a social perspective, digitalization in the extractive sector offers the potential to radically change the way and place work is performed. The incorporation of new technologies not only optimizes operations at mining sites, but also enables the creation of jobs that can be done remotely. This effect could extend to the service and supply sector, because digitalization impacts the supply chain (Storey, 2023). This shift in labor dynamics has particularly positive implications for certain demographic groups. For example, women may find more opportunities to enter the sector as roles are created that do not require physical presence at mines or extraction fields. Additionally, digitalization opens new doors for highly skilled professionals such as programmers, software developers, robotic system designers, and data analysts (Carbon Trust, 2022).

An additional area where digital technologies could have a positive impact on the extractive industry is in informed decision-making. The combined use of sensors, AI, data analytics, IoT, automation, augmented/virtual reality, and robotics enables the real-time simulation of mining production scenarios (Cacciuttolo et al., 2023). This facilitates the incorporation of occupational and environmental risk indicators to promote proactive decision-making and prevent undesirable outcomes.

However, it is crucial to consider the downside of this transition. While new opportunities are created for skilled workers, the demand for less-skilled labor may decrease, emphasizing the need to develop and implement relocation and reemployment strategies and training programs for these workers.

² A tool to present a map for public investment. See <https://www.iadb.org/es/reforma-modernizacion-del-estado/iniciativas-mapainversiones>.

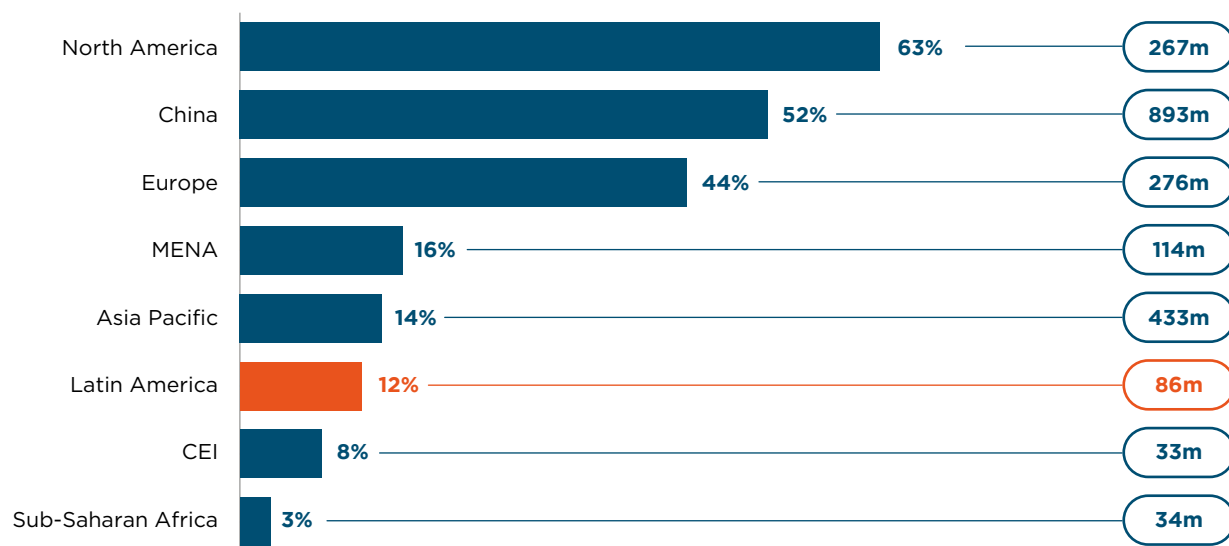
³ This refers to a person's confidence in their ability to affect the outcomes of involvement in a citizen participation mechanism, such as a community action board or council to discuss issues associated with a mining project.

5.2 The Andean Region faces challenges in the digitalization of the sector, ranging from a lack of knowledge to lagging mobile network penetration

Despite significant developments in digitalization, the extractive sector faces considerable challenges in achieving an optimal level of digital maturity. According to interviews conducted with various companies and institutions in the extractive sector, the major obstacles to digitalization range from limited economic resources to finance investment and a lack of knowledge regarding the associated benefits of adopting certain technologies (Carbon Trust, 2022). These obstacles are further exacerbated by a high aversion to risk when it comes to adopting new disruptive technologies, which is understandable due to the uncertainty and inherent costs associated with implementing innovative technologies.

These barriers become even more pronounced when a company is operating in a country with low connectivity, which can hinder access to and the effective use of digital technological tools. In remote regions, the lack of infrastructure and internet access form an additional obstacle for the adoption of digital technologies, both in extractive operations and the surrounding communities. Although 5G mobile networks promise to be a catalyst for digital transformation and facilitate the use of advanced technologies such as IoT and edge computing,⁴ Latin America lags behind in the deployment of 5G networks. According to projections by GSMA Intelligence (2021) by 2025, the penetration of 5G in Latin America is expected to reach 12%, a figure that is five times lower than the projected penetration level for North America (Figure 5.2).

Figure 5.2. 5G adoption by 2025 (% of total connections)



Source: GSMA Intelligence (2021).

⁴ This refers to the processing, analyzing, and storing of data closer to where it is generated in order to enable prompt, near-real-time analysis and response.



One of the most significant barriers to digitalization in the extractive sector in the Andean Region is the lack of coordination and alignment between the efforts of industry and academia. Extractive companies often lack clear strategies for developing technological solutions (Carbon Trust, 2022). Meanwhile, academia has the capacity to generate knowledge and technological developments, but faces resource constraints that limit its ability to conduct research and development comprehensively and effectively.

The lack of coordination and synergy between these two key actors can result in underutilization of technological potential and inefficient duplication of efforts. Such disconnection reduces the speed and scope of digitalization in the extractive sector of the Andean Region, inhibiting the optimization of the sector's operations. Furthermore, the absence of policies and regulations that incentivize the adoption of digital technologies constitutes another significant barrier. Without clear incentives to encourage the adoption of new technologies, companies may be reluctant to invest in digitalization, perpetuating the current challenges.

Despite the barriers that the extractive industry faces in the Andean Region in terms of advancing in digitalization processes, the sector has shown significant progress on various fronts. Cacciuttolo et al. (2023) highlight the digital transformation of Peruvian copper mines in projects such as Quellaveco (Anglo American), Antamina (BHP Billiton, Glencore, Teck), Cerro Verde (Freeport McMoran), and Yanacocha (Newmont).⁵ These projects have managed to become digital mines and as such leaders in

⁵ This is also the case with copper mines in Chile, such as Quebrada Blanca Phase II (Teck), Spence (BHP Billiton), Escondida (BHP Billiton), Gabriela Mistral (Codelco), El Teniente (Codelco), and the Chuquicamata subway mine (Codelco).

the copper mining industry 4.0.⁶ It is worth noting that these projects are large mining projects, and small- and medium-scale projects face greater constraints for digitalization due to limited access to financial resources, labor, and the risk involved in adopting new technologies.

Another example to highlight is Ecopetrol's⁷ digital transformation strategy in Colombia, which is based on three key elements: value generation, innovation, and transformation. This strategy consists of ten projects focused on efficiency goals, using digital technologies such as blockchain, AI, IoT, and machine learning. The projects include integrated field management, optimization of the gross refining margin, integrated commercial management, and digital financial management. The implementation of this strategy accelerated during the pandemic, allowing Ecopetrol to operate 85% of its plants remotely, thanks to an investment of US\$ 120 million from which returns of \$300 million are expected (Carbon Trust, 2022).

The digitalization of the extractive industry in the Andean Region presents a landscape of significant progress but also challenges to overcome. These challenges clearly highlight the need to address substantial obstacles in pursuit of transformative change, from the limited adoption of digital technologies in the industry to connectivity constraints and the lack of alignment between academia and the private sector. These challenges reflect not only a series of technical difficulties, but also a scenario in which the convergence of efforts between governments, educational institutions, and companies could play a fundamental role in addressing deficiencies and maximizing opportunities. In this intersection, there is an opportunity to create a digitalized environment that drives efficiency, sustainability, and competitiveness in the extractive industry, while promoting shared benefits for all parties involved.

⁶ The current technological transformation in which processes throughout the industrial value chain are being digitalized is commonly known as Industry 4.0.

⁷ Energy, oil, and gas company linked to the Colombian Ministry of Mines and Energy, which operates in all segments of the hydrocarbon chain: exploration, production, transportation, refining, and commercialization.

5.3 Governments, academia, and the private sector can be allies in the creation of a digitalized ecosystem

It is essential for the extractive industry in the Andean Region to realize the importance of digitalization and how these technologies can enhance efficiency, sustainability, and competitiveness. Investment in digital technologies can significantly improve productivity, reduce operational costs, and optimize the use of natural resources, all of which contribute to the addressing of the challenges of the energy transition and meeting of sustainability and social responsibility standards. Integrating digital technologies can be a challenge for established and smaller companies. However, for new and larger enterprises, the adoption of these technologies is inherent from the conception of the extractive project to its final implementation. These pioneering companies in digital technology adoption can lead the way for other companies facing higher risks and costs in their adoption.

According to a report by International Renewable Energy Agency(2022), digital technologies such as IoT, AI, and blockchain have great potential in smart mobility electrification. This would have an impact on the extractive industry in the region, where the use of electric vehicles could be increased. However, this requires the availability of various technologies, from electric-vehicle charging applications and mobility platforms to software platforms that enable energy management and smart charging. Innovations in network devices and digital solutions are needed for data sharing, resource management, and network optimization, enabling the widespread penetration of electric vehicles and renewable energy.

Technologies like IoT and AI can also be used in terms of occupational safety to achieve zero fatalities. These technologies can provide real-time data on working conditions and alerts about potential risks. One of GLASE's proposals, as documented in IDB (2020), is that in addition to adopting these technologies, clear and effective safety protocols and procedures, along with adequate training for all workers, should be established. Furthermore, in IDB (2020) it is emphasized that it is crucial to promote a culture of safety throughout the organization, encouraging responsibility for and compliance with standards, conducting continuous assessment of occupational risks, and implementing prevention and mitigation measures to ensure a safe and healthy working environment.

The use of technology can extend beyond the mine or oil well. Digital media can be used as an additional communication channel between companies and communities. As mentioned in Chapter 2, a key aspect of SLO is procedural justice, and for this it is important that communities are heard. During the 1990s, the use of environmental impact assessments (EIA)⁸ became widespread as part of the requirements imposed by environmental laws and regulations in the region to grant legal licenses for projects (Jaskoski, 2020). As a result of the EIA an environmental management plan (EMP) is established, which includes a plan for initiation, progress, and completion meetings for each project based on its duration. These mechanisms could be complemented with the use of digital technologies that facilitate communication outside of these spaces.

⁸ One of the key components of an EIA is the identification and evaluation of impacts through socialization work with the communities in the area of social influence of the projects. In the case of the presence of ethnic minorities, the EIA also includes the development of a prior consultation.

An example of this is the initiative by the Chilean mining company Antofagasta Minerals, which in 2015 began using social media platforms like LinkedIn, Facebook, Twitter, YouTube, Flickr, and Instagram to disseminate videos of their meetings with Transparency International⁹ (Carbon Trust, 2022).

To achieve broader adoption of digital tools, it is essential for extractive companies, government actors, and institutions in the region to work together to overcome economic and knowledge barriers. Governments can play a crucial role as key drivers of a digital ecosystem. It is essential to establish legal frameworks for spectrum use to facilitate the adoption of digital technologies in the extractive sector and to establish incentives and policies that promote the adoption of digital practices in the sector. Public policy can play a crucial role in aligning and standardizing different processes of digital transformation beyond the extractive industry. It is essential to consider cross-cutting issues in digital transformation, such as intellectual property protection, data privacy, and technology interoperability.

Additionally, human capital development is essential within a digital ecosystem. Therefore, it is vital to promote the training and development of the workforce in the use of digital technologies. Establishing centers for specialized development and training can generate synergies between the public and private sectors, facilitating the adoption of not only digital technologies, but also other innovative technologies (Carbon Trust, 2022). The model of the Digital Innovation Hubs (DIH), adopted in the European Union,¹⁰ is an example of a collaborative model in which companies are helped to increase their productivity and competitiveness through the adoption of digital technologies. DIHs are centers where companies are assisted in experimenting with new technologies before investing in them, improving their human talent, and accessing financial assistance (Wintjes & Vargas, 2023).

In addition to the benefits for companies, digitalization brings positive externalities that should not be overlooked. Leveraging governance in the Andean Region is one of them, as extractive activities have a significant impact on the socioeconomic conditions of local communities. Digitalization can reduce exposure to hazardous conditions and create safer environments for workers and communities. Likewise, digitalization promotes gender advancement by facilitating the integration of women in the sector, which must be complemented with inclusive employee-recruitment practices and inclusive career plans. Addressing gender stereotypes and biases that affect women in the extractive sector is also necessary. Promoting shared responsibility for care through parental leave and support policies is crucial for achieving real equality in the workplace. The following chapter delves more deeply into the topic of inclusion in the extractive sector.

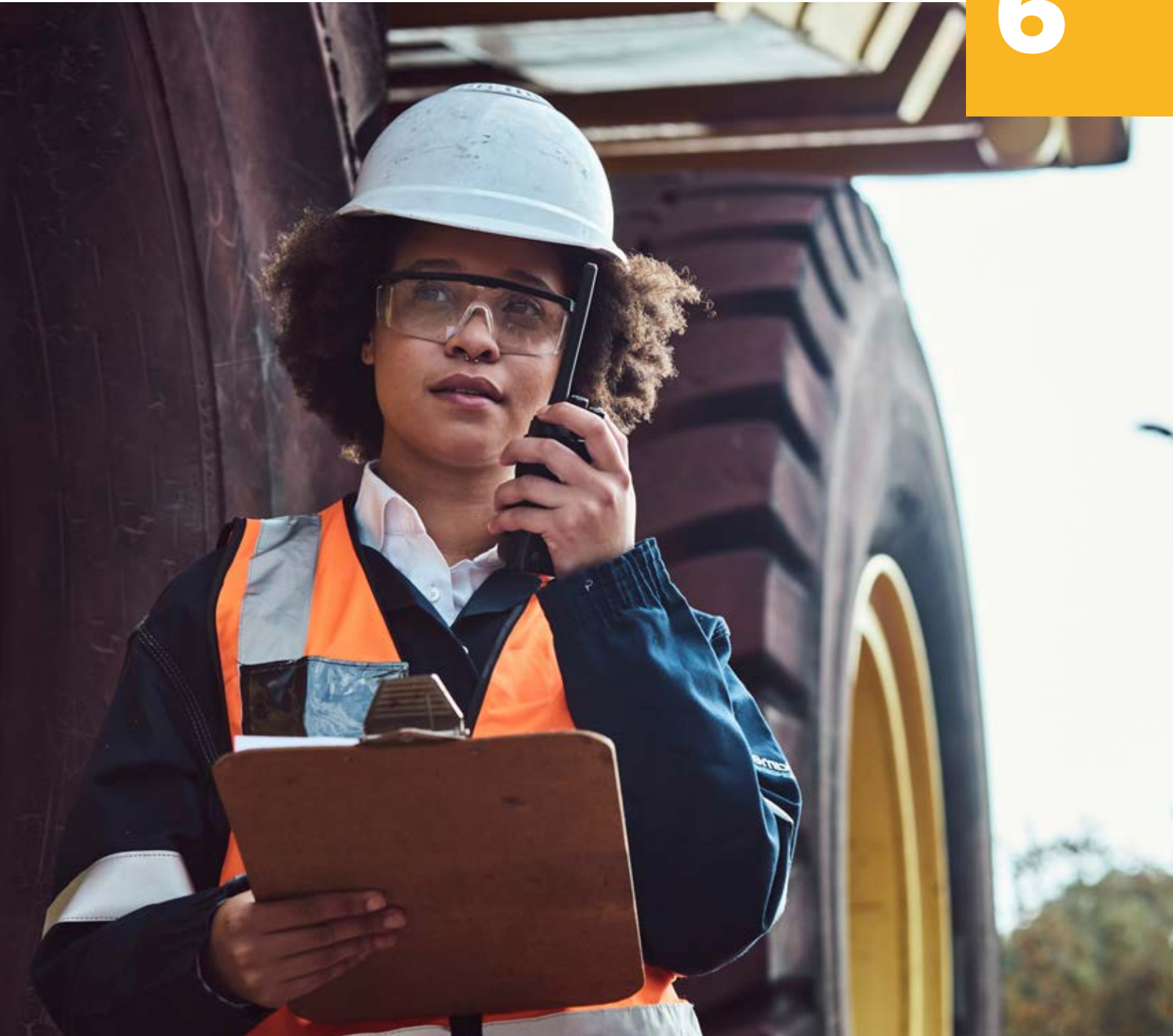
In conclusion, digitalization in the extractive sector in the Andean Region offers a unique opportunity to address the challenges of the energy transition and promote more-sustainable practices. By adopting digital technologies, companies can improve their environmental, social, and economic performance while generating shared benefits for the community, government, and the private sector.



Governments can play a crucial role as key drivers of a digital ecosystem.

⁹ This is an international, nongovernmental, nonpartisan, nonprofit organization dedicated to fighting corruption at the national and international level.

¹⁰ Some Latin American countries have experimented with this type of initiative (Wintjes & Vargas, 2023).



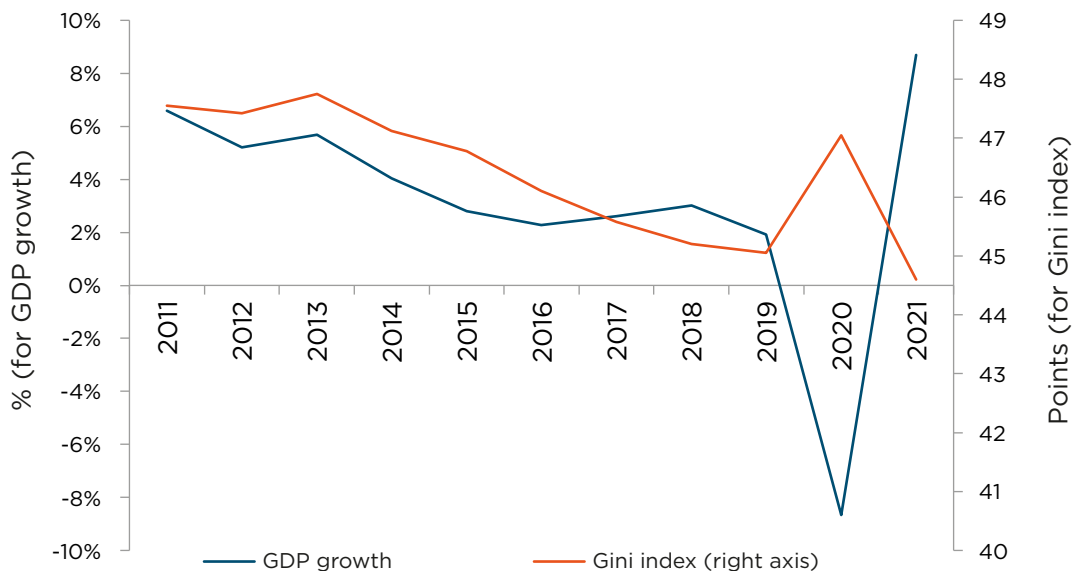
INCLUSION

6. WOMEN, ETHNIC COMMUNITIES, AND SMES

6.1 The gender gap and inequalities in the extractive sector

The Andean Region has experienced remarkable economic growth in recent decades. While this growth has shown a slowdown since 2014 and fell into negative territory in 2020 due to the COVID-19 pandemic, it has recovered in recent years. This development process has generated positive impacts on social conditions; however, its influence on inequality is limited (De la Cruz et al., 2020).

Figure 6.1. GDP Growth and Gini Index¹ in the Andean Region



Source: Prepared by the authors with data from the World Bank (2023b).

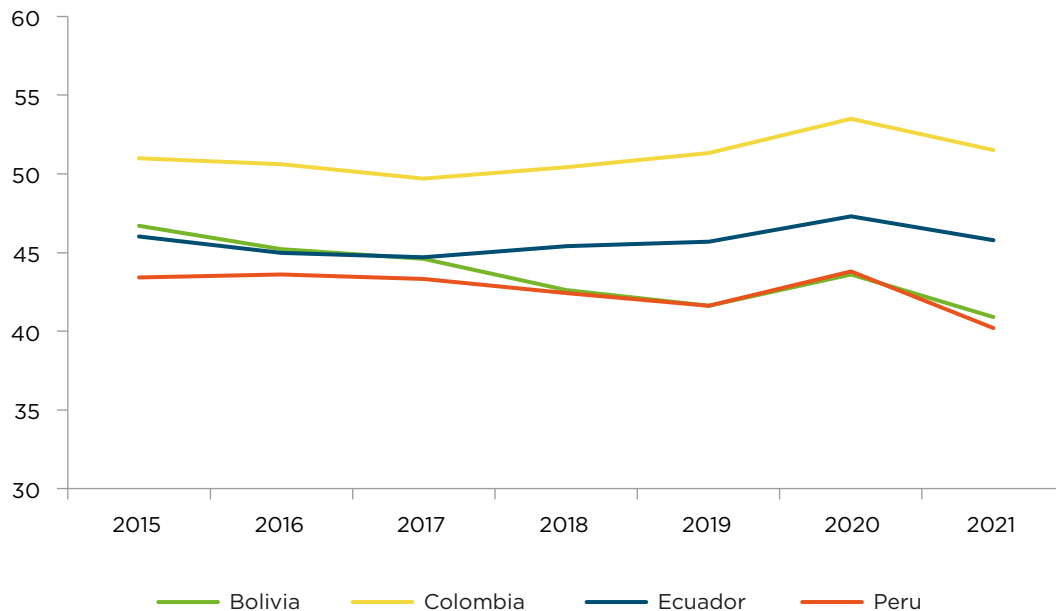
Note: GDP growth and Gini index for the Andean Region were calculated as the simple average of the countries and do not include Venezuela.

In the region, there is a concerning inequality and lack of inclusion with regard to certain social groups. According to Busso and Messina (2020), despite two decades of efforts to reduce levels of inequality in LAC, they continue to be alarming. In particular, in the Andean countries high inequality indices measured through the Gini index have been a significant cause for concern. The pandemic that has affected the world since 2020 worsened the situation, further exposing existing disparities. Although there was a slight decrease in

¹ A Gini index of 0 represents perfect equity, while an index of 100 represents perfect inequity.

Gini indices in 2021, inequality remains a significant obstacle to equitable and sustainable development in the region.

Figure 6.2. Gini index (points between 0 and 100)



Source: Prepared by the authors with data from the World Bank (2023b).

According to Andrián and Manzano (2023), income inequality leads to disparities in access to health care, education, employment, and the legal system. Vulnerable groups, such as women and indigenous communities, are particularly affected by this inequality, which is exacerbated by social stereotypes and lack of inclusion. This creates constant obstacles to their productive involvement in certain economic sectors, perpetuating inequalities.

One of the significant and concerning issues is the participation of women in the labor market, especially in the extractive sector. Unfortunately, women's presence in this industry is low and women face various limitations, depending on the field in which they operate. In LAC, the mining sector employs only 0.1% of women, in contrast to 0.8% of men (Stefanovic & Saavedra, 2016). It's also important to highlight that women are predominantly involved in small-scale mining. In the oil and gas industry, on the other hand, women represent only 21% of employees in Latin American companies (World Petroleum Council & Boston Consulting Group, 2021). According to Fernández-Stark and Bamber (2023), restrictions persist regarding the roles that women occupy in these sectors. Typically, they are assigned administrative and office tasks, while men mainly assume responsibilities related to operations and extraction.



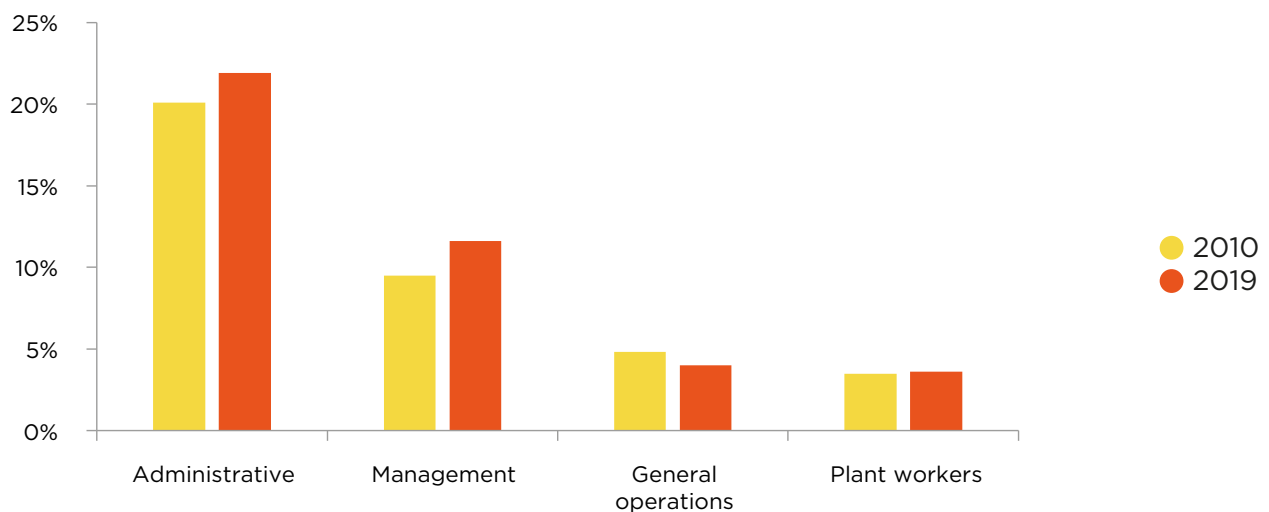
Vulnerable groups such as women and indigenous communities, are particularly affected by inequality, which is exacerbated by social stereotypes and lack of inclusion.

In Colombia, for example, according to the report from the Ministry of Energy and Mines (Ministerio de Energía y Minas, 2020), there is a marked male bias in job positions in the mining and energy sector, resulting in female participation below the national average. In the hydrocarbon sector, according to data provided by the Colombian Petroleum Association (ACP, for its acronym in Spanish) and Ecopetrol, female presence is limited to 24% of direct jobs (Ministerio de Energía y Minas, 2020). On the other hand, in the mining-industrial sector, the National Mining Agency (Agencia Nacional de Minería, 2022) presents data revealing an even lower proportion, where only 9% of the workers are women. This trend changes when considering small-scale and subsistence mines, which sometimes operate clandestinely. In this context, female presence becomes considerably higher, as 70% of informal jobs in the mining industry are performed by women (Martínez-Restrepo et al., 2022).

Gender disparity is also evident in the distribution of roles within the industry. According to the study by Martínez-Restrepo et al. (2022), this disparity covers both operational roles, corresponding to lower hierarchical levels, and high-level management positions. Female presence in the latter is considerably lower compared to other mid-level positions in the organizational structure. This inequality in role assignment reflects not only a lack of representation at the extreme levels of hierarchy, but also a tendency to relegate women to mainly administrative positions.

In Peru, the situation is also challenging, as only around 6% of the employees in the mining sector are women (Vaccaro, 2022a). Despite over 20% of the mining administrative workforce being women, their presence in general operations and plant personnel roles is less than 5%, and these figures hardly changed significantly from 2010 to 2019, according to data from the Ministry of Energy and Mines (Ministerio de Energía y Minas, 2020). It's worth mentioning that Perú and Mexico are countries with high wage differences in the extractive sector, as identified by De la Puente (2017).

Figure 6.3. Participation of women in the mining sector by job function in Perú (%)



Source: Prepared by the authors with data from the Ministry of Energy and Mines of Peru (Ministerio de Energía y Minas, 2020).

In the case of Bolivia, the indicators are also not encouraging. According to the National Institute of Statistics (Instituto Nacional de Estadística [INE], 2023), only 10% of the individuals involved in mining and quarrying activities in the fourth quarter of 2022 were women.² Furthermore, despite the progress that has allowed the inclusion of female labor force in the country's cooperatives, there is still a deeply rooted tendency to relegate women to support and assistance roles, resulting in wage disparities compared to their male counterparts (De la Puente, 2017). As highlighted by Chambilla (2016), female participation in decision-making levels also shows insufficient progress. In the cooperatives' board of directors, hierarchical positions like the president or administration president tend to be predominantly occupied by male miners, while roles like vocal and surveillance are often taken on by female miners.

In Ecuador, the results of the National Survey of Employment, Unemployment, and Underemployment (ENEMDU) in 2022 reveal that only around 10% of those employed in the mining sector are women. It's worth noting that this figure has not undergone substantial changes over the past decade, highlighting the persistence of these inequalities over time.

Furthermore, gender disparity is not limited exclusively to the extractive industry, as it extends to related sectors. In the Colombian context, the study conducted by Balza et al. (2021a) reveals that industries closely linked to the extractive industry have low levels of employment and a gender gap in their workforce structure due to limited female participation. This trend is significantly pronounced among women in production roles compared to administrative positions. This situation is also present in Perú. The research by Fernández-Stark and Bamber (2023) shows that the presence of women in mining sector suppliers is extremely limited, representing only 1.3% of the total.

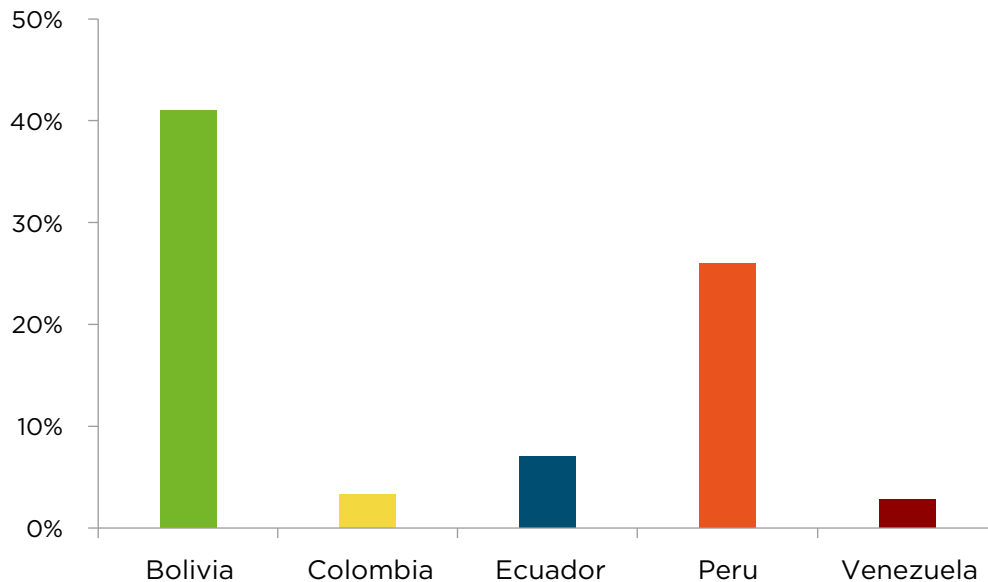
This pattern of inequality underscores the need to address these gender issues at all levels of the extractive value chain in order to establish a more equitable and sustainable economic environment. In this regard, to achieve greater inclusion it is crucial to implement policies and programs that promote equal opportunities and ensure the proper development of women.

Another highly relevant group in the extractive industry is indigenous peoples, whose presence is of special importance due to the frequent location of mining operations in rural areas inhabited by them. These indigenous communities hold a unique position, because their ancestral territories often contain valuable natural resources such as minerals and fossil fuels. This places indigenous communities at the center of the debate between economic development, cultural preservation, and environmental sustainability.

According to World Bank (2015), approximately 42 million people in Latin America belong to various indigenous communities. In the Andean region, specifically in countries like Bolivia and Perú, indigenous populations make up a significant portion of the demographic composition. As of 2010, in these countries these communities represented 41% and 26% of the total population, respectively. These proportions clearly demonstrate the profound influence and rich cultural heritage of indigenous peoples in these nations.

² According to INE (2023), these data are referential and apply to the population 14 years of age and older whose main occupation is mining and quarrying.

Figure 6.4. Proportion of the indigenous population in relation to the total population in the Andean Region in 2010 (%)



Source: Prepared by the authors with data from World Bank (2015).

Note: According to World Bank (2015), the number of people belonging to indigenous communities was estimated using “self-identification” in national censuses. However, in the case of Perú, the indigenous population was determined by considering as such all members of households in which the head of household speaks an indigenous language.

According to Damonte et al. (2014), in recent years there has been a gradual recognition of indigenous peoples as full citizens in several countries in Latin America. This evolution in recognizing their rights has opened the door to the possibility of establishing more-equitable relationships between governments, indigenous communities, and private companies interested in conducting extractive activities in indigenous territories.

In the Andean region, both Colombia and Venezuela have constitutions that recognize and safeguard ethnic and cultural diversity. In Perú and Ecuador, their respective constitutions acknowledge a multicultural nation with a republican, democratic, and representative system of government. In the case of Bolivia, its constitution goes a step further by recognizing indigenous peoples as nations within a plurinational state (Damonte et al., 2014).

Furthermore, international institutions have made efforts to safeguard the rights of indigenous and tribal peoples. The International Labour Organization (ILO) has adopted two significant legal instruments to address the situation of these groups. Convention No. 107 concerning Indigenous and Tribal Populations, adopted in 1957, marked the beginning of this work. However, it was in June 1989 that the ILO’s International Labour Conference adopted in a tripartite manner Convention No. 169 concerning Indigenous and Tribal Peoples in Independent Countries, internationally recognized as the most relevant instrument in this field (ILO, 2014).

Convention No. 169 covers a wide range of crucial issues for indigenous peoples, including the right to land, access to natural resources, health, education, vocational training, employment conditions, and cross-border contacts. In line with this goal, the ILO has launched the Project to promote the ILO’s policy

on indigenous and tribal peoples, known as PRO 169, with the purpose of promoting and supporting the implementation of the principles established in Convention No. 169 (ILO, 2007).

The World Bank has also implemented an Operational Policy on Indigenous Peoples (OP 4.10), which sets the rules for the planning and execution of projects that may affect indigenous communities. However, as Griffiths (2005) notes, the proper application of this policy has faced challenges, primarily due to a lack of capacity for implementation and limited dissemination among indigenous communities themselves. Concerns raised by indigenous peoples and civil society about issues in review and consultation processes are often disregarded, resulting in flawed consultations from the outset.

At the local level, Andean countries have recognized and implemented the right to prior and informed consultation before the implementation of extractive projects. These consultations are seen as a means to establish a dialogue between the state and indigenous populations with the aim of reaching agreements regarding decisions that could affect their collective rights (Leyva, 2018). Nevertheless, limitations persist that restrict influence on government decisions and policies related to extractive development.

Otro aspecto de interés para analizar es la participación de las pequeñas y medianas empresas (pymes) en la cadena de valor de la industria extractiva. A pesar de que a menudo son eclipsadas por las grandes corporaciones, las pymes contribuyen de manera significativa a la dinámica económica y social de las regiones donde operan, además de aportar diversidad y flexibilidad al panorama empresarial.

Another aspect of interest to analyze is the participation of small- and medium-sized enterprises (SMEs) in the value chain of the extractive industry. Despite often being overshadowed by large corporations, SMEs significantly contribute to the economic and social dynamics of the regions where they operate, while also bringing diversity and flexibility to the business landscape.

In the mining sector, local companies can be divided into three categories: medium-sized, small, and artisanal miners.³ As explained by Van der Veen et al. (1997), medium-sized mining companies play a significant role in countries with a long mining tradition, such as Bolivia and Perú, and they have highly competent technical teams. Small mining companies are characterized by generally inefficient management and limited profits. Furthermore, those operating informally lack long-term planning and do not pay due attention to environmental protection and social considerations. Finally, artisanal miners are known for operating informally. They face significant constraints in obtaining financing and technical assistance and are often located in remote and disadvantaged areas. Despite this, they make a significant contribution to the economy, especially through job creation (Bocangel, 2001).

Given this situation, there is a concern to ensure the optimal functioning of these companies and promote their formalization with the aim of paving their way to progress and overcoming potential obstacles. At the same time, there is an effort to improve the working conditions of a significant number of people, especially women, who operate in the informal sector. In response to this need, specific legal frameworks and regulations have emerged in Andean countries. For example, Colombia has established the National Policy for the Formalization of Mining. Ecuador, for its part, is notable for its Mining Law and the Regulation of the Special Regime for Small-Scale Mining, designed to address this issue. Similarly, in Perú, the Law for the Formalization and Promotion of Small-Scale and Artisanal Mining has been enacted as an essential measure to tackle this highly relevant challenge.

Despite such efforts, informality is a persistent challenge in this industry. In Colombia, according to the Mining Census of the Ministry of Energy and Mines, 75% of production units operate on a small scale

³ The size of the categories varies from country to country in terms of tons per day and annual sales.

and lack the necessary environmental permits (Ministerio de Energía y Minas, 2016). In Ecuador, various studies and government operations highlight the increase in illegal mining, particularly in the Amazon region (Bnamericas, 2023). On the other hand, in Bolivia, as noted by Bocangel (2001), gold mining is marked by a strong informal component, while in Perú, it is estimated that around 500,000 extractors are involved in informal mining activities (Conexión Esan, 2019).

Based on the foregoing, there is a clear need to recognize and address the entrenched inequalities in both the extractive industry and society at large. The promotion of gender equality, social inclusion, and equity in job opportunities should be the pillars for achieving sustainable and equitable development in the Andean region. Alongside these considerations, we cannot underestimate the role of SMEs. Their ability to generate local employment, diversify the value chain, and promote a more equitable relationship between companies and communities makes them vital actors in shaping a more inclusive and resilient business environment.

6.2 Integration of women, indigenous communities, and SMEs in the extractive industry still represents a challenge

The extractive sector plays a fundamental role in the economies of Andean countries. However, as mentioned earlier, this activity has also been a scene of social and economic inequalities affecting various groups. Therefore, the effective inclusion of women, indigenous communities, and SMEs is an urgent challenge that demands a coordinated and determined response.

In the first place, it is essential to effectively address the persistent gender inequalities in the context of the extractive industry. Despite the significant job opportunities it offers, this sector reflects a series of challenges in terms of gender equity. The very nature of the industry, which encompasses the extraction of natural resources such as minerals, oil, and gas, has historically led to an unequal division of roles and responsibilities based on gender.

According to Eftimie et al. (2009), there are notable differences in the access and availability of job roles between men and women in this sector. Roles directly related to extraction, often perceived as physically demanding and risky, have traditionally been predominantly occupied by men. In addition to this, cultural beliefs continue to act as barriers. For example, the deep-seated notion that women should not work in mines, supposedly because it negatively influences minerals (Martínez-Restrepo et al., 2022), hinders female participation in the extractive industry, especially in operational areas. This situation leads women working in the sector to occupy peripheral or support roles. Consequently, both the extractive industry and closely related sectors show limited female presence, relegating women to intermediate positions rather than allowing them to assume operational or leadership roles. These obstacles even push many women to seek employment in small informal-sector businesses.



The effective inclusion of women, indigenous communities and SMEs is a challenge that cannot be postponed and requires a coordinated and decisive response.

The low representation of women in the extractive industry can also be attributed to the low female presence in related educational and technical fields (Vaccaro, 2022b). According to UNESCO (2019), women's presence in STEM careers and related areas is limited,⁴ and a significant proportion of them drop out of these fields.⁵ This phenomenon may stem from deeply ingrained societal factors, such as gender stereotypes and the lack of female role models in these fields.

Some professional and technical areas have traditionally been considered male dominated, while others have been labeled as more suitable for women. In Perú, this trend is evident: as of 2021, only 0.2% of employed women worked in fishing and mining, in contrast to areas such as trade, agriculture, and other services, which accounted for 27.5%, 25.7%, and 36.4% of employed women, respectively (Instituto Nacional de Estadística e Informática, 2022).

Bolivia and Colombia exhibit similar patterns. Data from the INE (2023) and the Departamento Administrativo Nacional de Estadística (2023) show that for the last quarter of 2022, only 0.3% and 0.6% of employed women were engaged in mining and quarrying in Bolivia and Colombia, respectively. In contrast, fields like trade and agriculture attracted a higher number of women.

On the other hand, the occupational safety and health of women in the extractive industry are significant factors that must be taken into account. Labor conditions, often adverse and hazardous, affect workers both physically and emotionally. In the informal sector, where the majority of female participation is concentrated, these difficulties are exacerbated due to existing conditions and the lack of adequate sanitary facilities. Furthermore, the absence of gender-sensitive policies in the workplace exposes women to a higher risk of violence, harassment, and discrimination compared to their male counterparts. As noted by Vaccaro (2022b), sexual harassment and harassment are structural problems in mining.

Disparity in the labor market could even hinder progress toward greater income equality. According to a study by Reeson et al. (2012) in Australia, job generation in extractive projects could have differentiated effects by gender. The research reveals that in the case of men, income inequality tends to increase in proportion to the growth of employment in the mining industry in a region and then experiences a significant decline. However, for women, the trend is different, as income inequality increases across the entire spectrum of mining activities.

Despite the limited availability of information on this topic in the Andean region, these findings reinforce the need to comprehensively address ethnic and gender disparities in the extractive sector. Furthermore, it emphasizes the importance of conducting more-detailed research to gain a deeper understanding of how these dynamics manifest in the region and how they can be effectively countered.



⁴ The acronym STEM stands for Science, Technology, Engineering and Mathematics.

⁵ According to UNESCO (2019), there is a considerable number of women who choose to leave these disciplines behind at various stages, ranging from their period of study to their transition into the workplace and their career path.

While progress has been made in terms of gender equality in the region through initiatives and programs of various institutions and organizations, there are still obstacles that hinder the full and equitable participation of women in the value chain of the extractive industry. The gender imbalance in the extractive industry not only perpetuates discrimination, it also has a broader impact on society and the economy. In this regard, addressing these issues and promoting a more inclusive and equitable environment in the extractive sector will be essential for achieving sustainable and equitable development in the region.

Table 6.1. Main programs and initiatives for women in the extractive industry

| COUNTRY | PROGRAMS OR INICIATIVES |
|----------|--|
| Bolivia | Workshop on Female Female Leadership, Women Miners Leading Change |
| Colombia | Human Rights Policy for the Mining and Energy Sector Guidelines for Gender Equity in the Mining and Energy Sector |
| Ecuador | "I am a Miner" Scholarship Program |
| Peru | "Hatun Warmi" Program "Leading Mining Women" Program "Mining Women Talent" Programa "+ Mujeres in Energy" |

Sources: CAF (2022), Siroit and Irazábal (2022), Diario La Hora Ecuador (2022), El Peruano (2023).

Secondly, the inclusion of indigenous communities in the extractive sector also poses various challenges. Despite the recognition of territorial and consultation rights, research such as the study conducted by Damonte et al. (2014) highlights that indigenous communities still encounter obstacles in accessing national and international mechanisms designed to protect and ensure their rights. One of the central problems lies in the nature of the information provided to the communities about such projects. For example, in the case of Perú, Leyva (2018) points out that the information presented by the applicant to initiate the approval process is often superficial, dealing with irrelevant matters such as the delivery of certificates and the number of approved resolutions.

Damonte et al. (2014) also underscore that both governments and private companies tend to consider indigenous peoples more as consumers than as citizens with specific rights to the lands they have inhabited since time immemorial. In this context, Leyva (2018) emphasizes that mechanisms like prior consultations on extractive projects still do not manage to alter the asymmetric power dynamics between the state and indigenous peoples. In many cases, the measures to be consulted are defined by the state without the genuine participation of indigenous peoples. This perspective raises another significant challenge resulting in the lack of inclusion of the views of indigenous communities throughout the entire process.

Additionally, Berman et al. (2023) emphasize that the exploitation of mineral resources on the ancestral lands of these ethnic groups can intensify their sense of ethnic identity and provoke feelings of exclusion both politically and economically. By being excluded from decisions related to the exploitation of resources in their territories, these groups may feel that their rights are not considered in the decision-making process, which can, in turn, lead to a deep mistrust of the actors involved in the extractive industry. This

issue is highlighted in Chapter 2, where it is indicated that this feeling of displacement of communities due to extractive activities can lead to the emergence of conflicts that hinder project development.

In this context, it has been observed that the effective recognition of indigenous rights presents significant challenges for governments and companies responsible for extractive projects. The need to address these issues and foster a relationship of genuine respect and collaboration among the parties involved becomes a crucial aspect in moving toward a more equitable and sustainable approach in the extractive industry.

Finally, the effective integration of SMEs into the extractive industry should not be overlooked. Small and artisanal miners face obstacles in terms of access to financial and technological resources. This issue is not limited to companies in the extractive sector itself, as it also impacts their local suppliers, as detailed in Chapter 4. This limits their ability to compete with larger established companies and hinders the adoption of innovative practices. In this scenario, growth prospects for these companies are mostly restricted to the possibility of establishing partnerships with foreign investors or medium-sized mining companies (Van der Veen et al., 1997).

The formalization of companies is another serious concern in the sector. Operating in the informal sector, companies face even greater difficulties in accessing adequate financing to undertake larger-scale extractive projects. Compliance with complex regulations and legal requirements adds another level of challenge for these companies. Regulatory frameworks in the extractive sector tend to be rigorous, imposing high environmental and safety standards. This can be costly and highly complex for smaller companies, resulting in high levels of informality in the region. As indicated by Andrián and Manzano (2023), formalization implies a true transformation of productive units, which means that SMEs must enhance their capacities and efficiency to meet the rigorous requirements for quality and competitiveness demanded by the industry.



**The role played
by certain social
groups in the
extractive sector
must be reshaped.**

6.3 Comprehensive policies and solutions are needed to address the challenges of inclusion in the region

Based on the previous discussion, there is a concern about establishing concrete measures to address the challenges presented. Additionally, the role played by certain social groups in the extractive sector must be reconfigured. The inclusion and empowerment of women, indigenous communities, and SMEs take on a crucial role in the pursuit of a comprehensive and sustainable transformation of the extractive industry.

In this context, one of the initial issues to consider is the integration of women in the field of the extractive sector. Throughout history, this field has been predominantly composed of men, leading to a significant gender disparity in terms of job opportunities and presence in operational and leadership roles. Furthermore, the study conducted by Balza et al. (2021a) shows that this gender gap can extend to other areas related to the extractive industry that share similar characteristics. To effectively address this challenge, it is vital to implement concrete and coordinated measures that promote equal opportunities for women.

Among the fundamental measures to address gender inequality in the extractive sector, the importance of encouraging more women to start and continue their studies in STEM-related fields stands out. In this regard, the implementation of mentoring programs and the visibility of accomplished women in the STEM field can play a fundamental role in inspiring young women to pursue this path. Additionally, it is essential to maintain and expand funding and scholarship programs specifically aimed at women interested in STEM studies, as this can reduce economic barriers and promote their participation in these areas.

Martínez-Restrepo et al. (2022) emphasize that the promoting of female participation in STEM educational programs is an essential strategy to close gender gaps in the medium and long term. Encouraging women to choose careers related to science and technology creates a pathway for their integration into technical areas of the extractive sector, historically characterized by limited female presence.

To maximize the impact of these initiatives, it is crucial to address not only formal education but also confront the cultural obstacles and biases that can restrict female participation in fields traditionally dominated by men. Heshusius (2020) highlights the importance of challenging the notion that certain spheres of work are exclusively male. Therefore, work practices and policies must be implemented to allow women to enter sectors traditionally associated with the male gender, such as the extractive industry. This initiative will not only open new perspectives for women, but also enrich diversity and innovation in the sector.

Furthermore, it is of utmost importance to address gender biases and stereotypes present in companies and organizations in the extractive sector. According to the World Petroleum Council and the Boston Consulting Group (2021), companies must establish an approach that facilitates the attraction and retention of diverse talent. This implies ensuring that policies and processes are equitable and neutral in terms of gender and make use of a transparent and merit-based approach for evaluations.

An additional stereotype that requires special attention is related to the alleged higher costs associated with motherhood. Vaccaro (2022b) points out a potential bias against hiring women of reproductive age that is based on the mistaken perception that employing women in this stage may incur additional expenses. To address this issue, it is essential to foster an inclusive work culture where all individuals are valued for their skills and contributions, regardless of their gender.

Another aspect that could have adverse consequences for the hiring of women of reproductive age lies in the disparity between maternity and paternity leaves, which could create disincentives for hiring female personnel in this stage. To address this issue, Vaccaro (2022a) proposes equalizing maternity and paternity leaves or introducing shared paternity leaves, as implemented in various countries. Additionally, this

author emphasizes the importance of considering women's job continuity during pregnancy and advocates for creating incentives to encourage their return to work after the maternity period. These incentives should be designed in a way that ensures the proper development of their children while they reintegrate into the workforce.

Furthermore, it is crucial to ensure a safe and respectful working environment for women in the sector. This involves implementing clear policies aimed at preventing discrimination and gender-based violence. In addition, providing training to offer guidance for situations involving violence, discrimination, and workplace abuse for all staff is recommended, without distorting the nature of contracts (Vaccaro, 2022b). Training should focus not only on identifying and addressing problematic situations, but also on promoting a culture of mutual respect and understanding. Workshops and sessions can be designed in a participatory manner, encouraging open discussion and the exchange of perspectives. This will not only strengthen employees' commitment to gender equality, but also contribute to creating a more cohesive and supportive work community.

Finally, it is imperative to conduct further research that provides a more precise understanding of the current situation of the industry in the Andean region. As mentioned earlier, it is crucial to carry out a comprehensive analysis of how job creation in extractive projects, both within the industry itself and in related sectors, impacts the equitable distribution of income and its specific repercussions among different social groups. The results obtained from this research have the potential to form the fundamental basis for the development of specific strategies and policies aimed at directly addressing these disparities.

Regarding indigenous communities, it is of utmost importance to raise their visibility to facilitate their inclusion in public policies (Leyva, 2018). The active participation of these communities in economic sectors, especially regarding the exploitation of natural resources that directly affect them, is an essential step toward equity and mutual respect. However, to achieve genuine inclusion, it is necessary not only to recognize but also to protect the territorial, cultural, and ancestral rights of these communities (Damonte et al., 2014). Preserving and safeguarding their territories is vital for their identity and survival. Furthermore, it is essential to consider their traditions and knowledge and integrate them into development strategies and the sustainable management of natural resources.

Regarding the improvement of consultation processes for mining projects, it is essential to provide clear and understandable information about the proposed projects. Addressing the information asymmetries present is crucial to establishing a solid foundation for understanding and collaboration. To meet this challenge, Leyva (2018) emphasizes the importance of providing sufficient, accessible information adapted to the cultural context of each indigenous community and ensuring the availability of technical advice during the informational phases.



It is also essential to establish and strengthen a solid intercultural dialogue between the government, companies, and indigenous communities. This dialogue should be a space where the perspectives and knowledge of all parties involved are recognized and respected. Ongoing and meaningful exchanges can help establish relationships based on trust and collaboration, which, in turn, contribute to more-informed and fair decision-making.

Finally, implementing strategic measures to strengthen the participation of SMEs in the dynamics of the extractive industry in the Andean region is fundamental. In response to the inherent capital and technological resource limitations they face, an essential solution lies in promoting collaboration and partnerships between SMEs and external actors. This initiative could lead to alliances with foreign investors, allowing for a mutually beneficial synergy. Additionally, as noted by Aristizábal et al. (2021), another promising possibility is to strengthen the business plans of these companies, enabling more adequate access to financial products designed according to their capacities and needs.

To address the challenges associated with formalization, governments in the region can also play a crucial role by simplifying and streamlining regulatory compliance procedures. At the same time, they can provide technical and financial support to SMEs seeking formalization. Continuing specialized training and capacity-building policies and programs is another crucial aspect. This approach can increase the capacity and efficiency of these businesses, equipping them with the skills needed to meet industry standards.

Furthermore, as indicated by Van der Veen et al. (1997), the dissemination of the inherent benefits of formality can be a considerable incentive for companies to opt for the formalization process. Highlighting the fact that legalization can improve their access to business opportunities, financing, and collaboration can stimulate the motivation for SMEs to engage in this process and move toward a stronger position in the industry.

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