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## WOMEN AND THE MINE OF THE FUTURE

## A Gendered Analysis of Employment and Skills in the Large-Scale Mining Sector: Chile Case

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- International Labour Organization
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## WOMEN AND THE MINE OF THE FUTURE <br> A Gendered Analysis of Employment and Skills in the LargeScale Mining Sector: Chile Case

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## EXECUTIVE SUMMARY

The mining industry is facing great challenges, especially in issues related to the inclusion of women in the industry. In view of this, and with the aim of closing information gaps, the Women and the Mine of the Future project was launched under the sponsorship of a group of international organizations, including the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF); the Swedish Environmental Protection Agency (SEPA); the United Nations Development Programme (UNPD); International Women in Mining (IWiM); and the International Labour Organization (ILO). The purpose of this project is to obtain a diagnosis of the status of women's participation in the mining workforce, particularly in Latin America. The countries chosen for the study are the following: Argentina, Brazil, Colombia, Peru, and Chile.

Thus, this report will analyze the status of women in Chile's mining sector through a quantitative and qualitative analysis of relevant public and private sources available. It is important to note that large-scale mining in Chile has a significant influence on its economy; large-scale mining accounted for $14.6 \%$ of GDP and $62 \%$ of exports in 2021, and accounted for $15 \%$ of investments in 2020 (Consejo Minero, 2022) in Chile. In addition, large-scale mining represented $9.7 \%$ of all government revenues between 2010 and 2021. This shows the significant role that the mining sector plays in the labour market in Chile. Mining companies are estimated to directly employ $3 \%$ of the total workforce in Chile, and for each direct mining job, 2.55 jobs were created in the different regions of the country. This means the mining industry accounts for about $10 \%$ of total employment in Chile (Chile Mining Council, 2023).

However, women's participation in the industry increased 2.4 times, compared to a 1.4 times increase in male workers, with 27,715 women employed in 2021. This higher increase reflects a positive trend in the percentage of women in the total mining workforce, which went from $6.16 \%$ in 2010 to $10.06 \%$ in 2021. Between 2010 and 2021, women's participation in the mining workforce grew 1.6 times, with an average increase of $4.6 \%$. This report shows that the provinces of Norte Grande and Norte Chico have a larger workforce in percentage, and that women's participation is higher than in the southernmost and the central regions. Norte Grande and Norte Chico contain most of the mining activities in Chile, with $81.9 \%$ of the total workforce of the industry: female participation at the mine sites in this area represents $84.2 \%$. The highest percentage of women's participation per region is found in the regions of Norte Grande (10.8\%) and Norte Chico (9.4\%). Within these regions, the provinces with higher participation rates are Antofagasta (11.6\%), followed by Coquimbo (10.2\%) and Atacama (9.0\%). When considering women's participation specifically by mineral extracted, the highest growth between 2018 and 2020 took place in the category of "other minerals" ( +4.5 percentage points), followed by gold ( 3.7 percentage points), iron ( 2.0 percentage points), and copper ( 1.5 percentage points). In particular, women's participation in the mining industry is higher in those provinces with more than 20,000 employees. Between 2018 and 2021, the provinces with fewer than 20,000 employees increased women's participation by only
$0.91 \%$, while provinces with a larger workforce did so by $1.9 \%$ (more than double). This reflects a significant setback in small provinces.

Another interesting finding is that domestic companies represented the highest rate of women's participation in 2021 (10.8\%), followed by international companies (10.5\%), and state-owned companies (10.1\%). On the other hand, in terms of education level, out of the total of female graduates between 2010 and 2020, 62,809 women graduated from fields relevant to the mining industry. Therefore, based on the study called "The Workforce for 2021-2030 Large-Scale Mining in Chile" (CCM, 2021), it is estimated that as of 2020, only about $57 \%$ of women have followed Technical and/or Professional studies. As of 2021 there are 27,715 women working in the mining industry, although not all of them have technical and/or professional levels of education (SERNAGEOMIN, 2021). In this sense, according to the authors' estimates, as of 2021 only $25 \%$ of female professionals and technicians who graduated between 2010 and 2020 were currently performing activities related to the mining industry.

When considering the government's expenditure on education, Chile allocates $3.6 \%$ of its GDP to primary and secondary education; $3.0 \%$ of that $3.6 \%$ derives from resources conferred by the government. Female participation is low in STEM-based education programs, but this rate tends to increase at higher levels of education. In Chile, higher education technical programs in STEM-based areas present $12 \%$ of female enrollment, while female participation in professional programs amounts to $22 \%$ (Ministerio de Educación, 2019).

Particularly in terms of gender pay gaps, by 2020, in the Cleaning and Restaurant Services category, women earned $49.7 \%$ less than men; this being the biggest gender pay gap in the mining industry in Chile. In addition, there is a $17.9 \%$ gap in the miner category, which is the main base activity of mining, as well as a $5.8 \%$ pay gap between men and women in professional career positions. This difference confirms that women working in the industry do not have the same economic benefits.

However, from the institutional perspective of public policy-making, the consolidation of women's participation in the mining industry has been progressing throughout the last decade. In 2017, the Ministry of Mining, the Ministry of Women and Gender Equity, and different representatives from the mining industry signed the Guidelines of the Mining Industry for the Incorporation of Women and the Reconciliation of Work, Family and Personal Life. The purpose of these guidelinesis advancing and developing suitable work conditions for men and women; increasing female participation in the sector; and increasing women's presence in decision-making positions. Furthermore, and with the aim of improving women's opportunities in the mining industry in Chile, the government, through public policies, has implemented different initiatives and guidelines, such as the NCH 3262-2021 Standard on "Management System of Gender Equality and the Reconciliation of Work, Family and Personal Life," which is a management instrument that sets gender inclusion requirements for organizations (SERNAMEG, 2021). Through Chile's Woman and Mining Roundtable, led by the Ministry of Women and Gender Equality and
the Ministry of Mining, the Best Gender Practices for the Mining Sector 2018-2020 were designed with a series of specific actions to promote women's participation in the industry.

In conclusion, and despite the progress achieved in women's participation in this industry, there are still significant challenges for women's inclusion in the Chilean mining sector. One of the biggest obstacles is the existence of persistent gender-based stereotypes as well as sexist attitudes, which frequently hinder the advancement of women in the sector. In addition, the lack of infrastructure and adequate services in mining areas usually makes it difficult for women to find suitable housing and childcare services. Although some progress has been made in terms of women's participation in the Chilean mining sector, there is still a lot to be done. Broader measures are needed to address gender gaps in the mining sector, such as removing gender-based barriers and cultural stereotypes, developing more inclusive labour practices, and creating networks and associations to support women working in the industry. Only through greater women's participation in the mining sector can Chile fully harness the economic and business benefits of the mining industry.

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## ACRONYMS

| CASEN | Chilean Socioeconomic Characterization Survey |
| :--- | :--- |
| CCM | Chilean Mining Skills Council |
| EGP | Environmental Governance Programme |
| IGF | Intergovernmental Forum on Mining, Minerals, Metals and <br>  <br> Sustainable Development |
| IWIM | International Women in Mining |
| ILO | International Labour Organization |
| SENCE | Chile Service of Training and Employment |
| SERNAGEOMIN | Chile Geology and Mining Survey |
| SERNAMEG | Chile Ministry of Women and Gender Equity |

### 1.0 INTRODUCTION

The mining sector has been facing short-term challenges that will change the organization, development, and evolution of the industry. These challenges include the adoption of modern technologies, increasing demand for minerals needed for the energy transition, and the need to implement high environmental and social standards.

These changes will have different impacts on men and women. However, available global statistics on gender for the large-scale mining sector are disparate or insufficient to understand the implications of the technological and organizational changes the industry is facing. Detailed information is needed for a better understanding and to design and implement appropriate public policies. Gender-disaggregated statistics required for the analyses include, among others, participation rates in the workforce by occupation, education level, location, and income. Additionally, gender-specific data on communities adjacent to mining projects and supply chains are required. With this information, proper diagnosis could be made, allowing to minimize impacts and maximize the contribution of large-scale mining to Sustainable Development Goal 5, Gender Equality.

With the purpose of closing these information gaps, the project Women and the Mine of the Future has been launched. This project was designed by a group of international organizations, including the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF), the Swedish Environmental Protection Agency, the United Nations Development Programme (UNDP), International Women in Mining (IWiM) and the International Labour Organization (ILO). The purpose of this project is to diagnose the status of women's participation in the mining sector and comprises three phases: the first phase is intended to establish a baseline of gender statistical information for a group of selected countries; the second phase seeks to understand the occupational profiles required to address the changes in the mining sector; and the third phase includes the role of women in mining supply chains. The Latin American countries selected for the first phase are Argentina, Brazil, Colombia, Chile, and Peru.

This document is the report on Chile for the first phase of the project Women and the Mining of the Future. This report seeks to assess the status of women based on relevant information available. While Chile is a country recognized as a large mineral producerthe mining sector contribution to Chile's GDP amounted to $12.5 \%$ in 2020-the participation of women, on average, has not exceeded $11 \%$ in the last decade (Consejo Minero, 2021). Given Chile's significant number of copper mine sites in operationrepresenting more than $26 \%$ of the world's copper production ${ }^{1}$-as well as its potential as supplier of other minerals critical for energetic transition, such as lithium, Chile's mining industry is expected to continue growing. Understanding gender dynamics in Chile's

[^0]mining sector evolution ahead will be essential to ensure future equitable growth for women in the industry.

This report will analyze the status of women in Chile's mining industry through a quantitative and qualitative analysis of relevant public and private sources available. The report is divided into five sections. This introduction is the first section. The second section will describe the importance of mining in Chile's economy and the participation of women in the economy as a whole, and in mining in particular. The third chapter will analyze the women's participation in the industry by mine site, mineral type, region, and pay gap using studies and databases from Consejo de Competencias Mineras (CCM - Mining Competencies Council) for 2019, comprising 13 large-scale mining companies (43,942 persons) and 17 large-scale mining suppliers ( 17,336 persons), and the CCM 2021 study, comprising 14 large-scale mining companies ( 46,412 persons) and 13 large-scale mining suppliers ( 176,496 persons). In addition, the study Mining and Women prepared by CCM in 2020, including a sub-sample of 3,894 women in the mining sector, was also used for the analysis. The fourth chapter will carry out a qualitative analysis of the status of female employment in mining. Finally, section five will present the conclusions and challenges to improve women's participation in Chile's mining sector.

### 2.0 OUTLOOK FOR WOMEN AND MINING IN CHILE

This section will present an overview of Chile's mining sector and the role of women in this industry and will explain the reasons for women's low participation in the industry.

Large-scale mining is a large contributor to Chile's economy; it accounted for $14.6 \%$ of GDP, $62 \%$ of exports in 2021, and $15 \%$ of investments in 2020 (Consejo Minero, 2022). Also, Chile's mining sector accounted for $9.7 \%$ of all tax revenues between 2010 and 2021, becoming a highly relevant industry for Chile's economy. Moreover, this sector plays a key role globally, as Chile is the main producer of copper, accounting for almost $26 \%$ of the world's production in 2020, and the second largest producer of molybdenum, accounting for $17 \%$ of the world's molybdenum production in 2021 (Consejo Minero, 2022).

The mining sector also has a relevant role in Chile's labour market. Mining companies are estimated to directly employ $3 \%$ of Chile's total labour force and that for each direct job, an additional 2.55 jobs are created in different regions; in other words, mining's contribution to Chile's total employment is about 10\%. (Consejo Minero, 2023). Regarding wages, the 276,000 persons working in the mining sector get high compensation, with an average income of more than 1,916,000 Chilean pesos (USD 2,224.74 - Dec 2022), exceeding the average monthly taxable income of all other economic activities by more than double ( 927,000 Chilean pesos - USD 1,076.38 - Dec 2022). (Consejo Minero, 2022).

Despite its economic importance, women do not receive equal treatment in Chile's mining sector. Regarding women's participation in the mining labour force, about $90 \%$ of mining workers are men, which is why the sector is considered a highly masculinized industry. ${ }^{2}$ Only $10 \%$ are women, which is far from the average in other mining countries such as Canada, where women represent $18 \%$ of the mining labour force. In terms of occupation level, according to the CCM (2020), women account for $16.9 \%$ of positions at the director and manager level, $12.6 \%$ of deputy managers and supervisors, $15.7 \%$ of managers and $9.9 \%$ of supervisors. Analyzing women's participation in the value chain by occupational tier, the study shows that women account for $2.8 \%$ and $7.9 \%$ of workers in maintenance and mine operations, respectively. In terms of age, the average age of women in mining is 40 years; around $14.9 \%$ are on average younger than 30 years; while $2.3 \%$ are 60 years or older. In the youngest segment, i.e., women under $30,41 \%$ of women work as operators, i.e., within the main value chain, while $24 \%$ perform other tasks outside the value chain.

[^1]There are also inequalities in terms of pay. As seen above, the mining industry is one of the best-paid sectors in Chile. However, women in professional and operational roles earn on average $12 \%$ less than men (CASEN, 2020). When analyzing the median income in mining, the pay gap between men and women is $3 \%$, suggesting, together with the average income, that the best-paid jobs are more concentrated among men than among women. When analyzed by region, this pay gap phenomenon is more prevalent in the region of Antofagasta. This is partly explained by the gender-stereotyped distribution of roles that are replicated in different industries, with greater emphasis on male-dominated sectors such as mining, where women have been and continue to be under-represented, especially in positions of greater power, as well as in positions directly linked to the value chain, such as maintenance and operations, for example.

## There are several reasons for women's low participation, pay gap, and occupational

 level in mining. Working in a highly male-dominated environment is a challenge for women who have to prove themselves to men and constantly show that they are capable of doing their job; this has an impact on the mental health of female workers. The working conditions for women in the mining sector are, therefore, unequal "as conditions do not allow for the creation of a proportional incorporation in terms of equal opportunities" (Rojas, 2016), with inequalities in career development opportunities. Other industries with a low female workforce in Chile are construction and agriculture, which account for $7 \%$ (CChC, 2021) and $24.2 \%$ (PRODEMU, 2021) respectively.
## The nature and location of mining activities explain the masculinization in this

industry. Mining is characterized by jobs in remote locations far from urban centres, often at high altitudes and in extreme weather conditions, shift systems involving several days away from home, elevated risk of accidents, exposure to pollutants and high physical demands. This working scenario, which has led to mining jobs being perceived as men's work, the fact that women work double shifts, and the cultural pressure on women to devote themselves to domestic work and care, makes mining a highly male-dominated industry. All the above by itself also discourages the participation of women in the industry and results in women adopting "different validation strategies to cope with the adverse environment they face, and they pay the consequences for doing so" (Rojas, 2016). Increasing women's participation in male-dominated industries is a major challenge for Chile.

## Finally, mining involves high physical risks and extreme environmental conditions.

 In this regard, mining jeopardizes workers' physical and mental health "not only because of the above mentioned conditions of high altitudes, the exposure to extreme temperatures and shifts far away from home, but also because of the stereotypes of female and male behaviour" (Rojas, 2016). The effective integration of women in the mining sector is therefore a challenge that requires an organizational policy addressing inequalities and facilitating women's professional development in this industry. Women's integration is also a huge opportunity to change the reality of many families, allowing more women to have roles in decision making and in positions of power in an industry that is so important for Chile.This section highlighted the importance of mining in Chile's economy, the gender inequalities in the mining sector in terms of women's participation, occupation, age, and income, and suggestions that explain these inequalities. The following sections attempt to provide a more detailed picture of the status of women in Chile's mining sector based on available statistics.

### 3.0 DATA ANALYSIS ON THE STATUS OF WOMEN IN CHILE'S MINING INDUSTRY

In this section, a comprehensive data analysis on the status of women in the Chilean mining sector will be performed. To that end, we will be using public data collected from the 2019 CCM report, comprising 13 large-scale mining companies ( 43,942 persons) and 17 supplier companies of large-scale mining (17,336 persons), and from the 2021 CCM report, comprising 14 large-scale mining companies ( 46,412 persons) and 13 supplier companies of large-scale mining ( 176,496 persons). In addition, reports from the Chile Geology and Mining Survey (SERNAGEOMIN) between 2010 and 2020 will also be used, as well as a detailed database per mine site with data since 2018 provided by SERNAGEOMIN.

This chapter is divided into 12 sub-sections that will address the analysis from the perspective of female labour participation, the occupations within the mine site, the type of mineral, the geographical division, the type of ownership of the mining company, the education level, the positions of power, the professional opportunities for women, and government spending.

### 3.1 Analysis of Total Participation of Women in Chile's Mining Sector

In this subsection, the evolution of overall participation of women in Chile's mining sector is analyzed based on the most recent Yearbook of Mining in Chile, published by SERNAGEOMIN (SERNAGEOMIN, 2021). Figure 1 shows the total mining workforce, both for men and women, in mining companies and mining contractors between 2010 and 2021:

Figure 1. Workforce at mine sites, classified by gender between 2010 and 2021.


Source: Authors' estimate based on information obtained from SERNAGEOMIN (2021).

Figure 1 shows that since 2010 the number of employees in the mining industry has increased 1.4 times, from 191,043 to 275,575 employees. The number of female workers has increased 2.4 times, compared to a 1.4 increase in male workers, with 27,715 women working in the mining sector in 2021. This greater increase reflects a positive trend in women's participation rate in the total mining workforce, which went up from $6.16 \%$ in 2010 to $10.06 \%$ in 2021, as shown in Figure 2.

Figure 1. Growth of women's participation in Chile's mining workforce (2010-2021)


Source: Authors' estimate based on information obtained from SERNAGEOMIN (2021).
The above graph shows the significant increase in female participation in mining over the last 12 years in Chile. Between 2010 and 2021, their participation grew by 1.6 times with an average annual rate of $4.6 \%$

### 3.2 Analysis Based on the Size of the Mine Site

In order to analyze women's participation rate by mine site and mine site size, a database provided by SERNAGEOMIN comprising 19,180 women and 208,974 men in 2018; 21,309 women and 22,5251 men in 2019; 21,834 women and 209,562 men in 2020; and finally, 26,594 women and 237,283 men in 2021 was used.

To carry out this analysis, women's total participation rate is estimated as the total amount of female mining workers versus the total amount of workers in this industry. The average is estimated by adding up the average amount of male and female workers by mine site every year. ${ }^{3}$ Table 1 shows the results compared to participation rate:

[^2]Table 1. Total participation vs. average of women in Chile's mining sector

|  | Total | Average | Difference |
| :--- | :--- | :--- | :--- |
| 2018 | 8,40 | 5,73 | 2,67 |
| 2019 | 8,53 | 5,97 | 2,56 |
| 2020 | 8,58 | 6,06 | 2,52 |
| 2021 | 10,03 | 6,61 | 3,42 |

Source: Authors' estimate based on information obtained from SERNAGEOMIN (2021).
This table shows that average women's participation by site and size of mine site is significantly lower than women's participation over the total mining workforce (between $2.5 \%$ and $3.5 \%$ ). This difference between the average in mine sites and women's total participation makes us wonder how women's participation is distributed among the mine sites. However, and despite this, women's total participation rate as well as its average show an increase during the periods under study.

In order to understand this difference, an analysis was carried out by dividing companies into three groups: large, medium-sized, and small companies. Small mine sites were defined as having 2,500 employees or fewer; medium-sized mine sites as having between 2,500 and 9,000 employees; and large mine sites as having 9,000 or more employees. The information below details sample population as well as the results of estimating average women's participation rate per year for each type of mine site category:

Table 2. Average women's participation rate based on the size of the mine site

|  |  | Small | Medium | Large |
| :---: | :---: | :---: | :---: | :---: |
| 2018 |  | 5,57 | 8,78 | 8,49 |
| 2019 |  | 5,57 | 9,26 | 8,63 |
| 2020 |  | 5,75 | 9,95 | 9,72 |
| 2021 |  | 6,31 | 10,58 | 10,19 |
|  | Participation \% | 5,80 | 9,64 | 9,26 |
|  | \# Mine Sites | 346 | 18 | 6 |
|  | \# Workers | 76.599 | 81.905 | 66.447 |

Source: Authors' estimate based on information obtained from SERNAGEOMIN.
As shown, large mine sites tend to have a higher female participation rate than small ones in any given period. Thus, it can be concluded that large mine sites boost global participation rates, whereas small mine sites, which are greater in number, tend to drag the average down.

### 3.3 Geographical Analysis

The information provided by SERNAGEOMIN allows us to carry out an analysis of women's participation by province, and this territorial subdivision is more specific than the information that could be obtained based on a regional analysis. We followed the same procedure we had applied in the analysis by mine site, comparing global female participation per province, taking into account the total amount of women and men working during the year in each province, and an average of the participation rates in the provinces throughout the year to see how women's participation is distributed among provinces. In the subsequent analysis, provinces with fewer than 30 female workers were removed as this does not represent the reality of the industry.

Figure 2. Women's participation rate in mining workforce by geographic area vs total Chile rate, 2021


Source: Authors' estimate based on information obtained from SERNAGEOMIN.
As shown in the figure above, there is a heterogeneous geographical distribution of women in the mining industry, so increasing women's participation in the provinces lagging behind would definitely constitute a significant challenge. The provinces of Norte Grande and Norte Chico have a larger workforce in percentage, and, in addition, there is a higher women's participation rate than in the Central and Southern Regions. Norte Grande and Norte Chico contain most of the mining activities in Chile, with $81.9 \%$ of the total workforce, and also represent $84.2 \%$ of women's participation at mine sites, thus confirming the earlier finding that larger mine sites have higher women's participation than small ones.

Figure 4. Percentage of women's participation in mining workforce by region vs total regional rate, 2021


Source: Authors' estimate based on information obtained from SERNAGEOMIN.
This database also allows us to carry out an analysis by region. The highest participation rate of women at a regional level is found in the regions of Norte Grande (10.8\%) and Norte Chico (9.4\%), which also concentrate the highest amount of mining workers. In these two regions, the provinces with higher participation rates are Antofagasta (11.6\%), followed by Coquimbo (10.2\%), and Atacama (9.0\%). As shown in Figure 3, the central and southern provinces have less than a quarter of the total mining workforce. Women's participation rate per region ranges from 2.0\% in Biobío to $9.7 \%$ in Magallanes and the Antarctic Regions. However, in this last region, there are only 360 workers.

Figure 5. Percentage of participation of female mining employees by province vs total provincial rate, 2021


Source: Authors' estimate based on information obtained from SERNAGEOMIN. ${ }^{4}$
Finally, an analysis of women's participation rate by region and province can be performed with the database available. In this case, provinces with more than 100 employees were considered. Within Norte Grande, the highest labour participation rate for women was found in El Loa (11.9\%) and the lowest in Parinacota (4.2\%). In Norte Chico, the highest rate was found in Choapa (10.4\%) and the lowest one in Chañaral (7.9\%). The Central Region reflects the highest range with $13.1 \%$ of participation in the province of San Felipe vs. $0.9 \%$ in the province of Arauco. Finally, in the Southern Region, the province of Magallanes presented the highest participation rate with $12.2 \%$.

As shown in the analysis by mine site, larger provinces usually have about 10\% of women's participation, whereas most smaller provinces have a lower rate. This may be due to the fact that the location of larger mine sites concentrated in certain provinces results in those provinces also having the highest number of employees, as is the case in Norte Grande and Norte Chico. This can be confirmed by estimating the average

[^3]participation rate for women from two different groups: provinces with more than 20,000 employees vs provinces with fewer employees. The result obtained is as follows:

Figure 6. Women's participation rate by size of the province


Source: Authors' estimate based on information obtained from SERNAGEOMIN.
Figure 6 shows that the increase in women's participation in the mining industry is higher in those provinces with more than 20,000 employees. Between 2018 and 2021, in provinces with fewer than 20,000 employees, women's participation increased in only $0.91 \%$, while in larger provinces the increase was $1.9 \%$ (more than double). This reflects that small provinces are lagging significantly behind. This may also be due to the fact that medium-size and large mine sites, located in certain provinces, have been devoting some efforts to increase women's participation, whereas small mine sites have fallen behind.

### 3.4 Analysis by Type of Mineral

In this section, women's participation in mining workforce sector will be analyzed per the type of mineral. To that end, data from operations with more than 2,000 employees were selected for each year. Although most companies are dedicated to copper extraction in Chile, the analysis also considered companies extracting copper, gold, iron, and other non-metallic minerals (iodine and lithium, among others). Figure 7 shows the evolution of women's participation in the mining sector according to the type of mineral extracted:

Figure 3. Evolution of women's participation in Chile's mining workforce by type of mineral (2018-2021)


Source: Authors' estimate based on information obtained from SERNAGEOMIN.
Figure 7 shows that between 2018 and 2021 there was an increase in women's participation for all minerals considered. The category that reflected the highest increase during that period is "Other minerals" ( +4.5 percentage points), followed by gold (3.7 percentage points), iron ore ( 2.0 percentage points), and copper ( 1.5 percentage points). When comparing between minerals, findings indicate that the highest rate for women's participation is found in other non-metallic minerals (12.1\%), followed by copper (10.7\%), gold ( $10.7 \%$ ), and iron ore ( $9.4 \%$ ). For all minerals, women's participation rate is similar to Chile's total average of $10.06 \%$, with the exception of iron ore.

### 3.5 Analysis by Type of Mining Ownership

In this section, women's participation in the mining workforce will be analyzed according to the different types of mining company ownership. In particular, women's participation share among three types of companies is analyzed: state-owned companies, defined as companies that are property of the state; national companies, i.e., companies with mainly domestic investors; and international companies, comprising foreign capital companies. ${ }^{5}$

For the analysis per the type of ownership and to reduce the sample population in a way similar to the reduction in the previous section, data was selected so as to consider mine sites having more than 2,000 employees for each given year. Although most companies

[^4]are dedicated to copper extraction, operations working with iron ore and gold, as well as other non-metallic minerals, were also included in the analysis. The information considered represented, on average, $85 \%$ of women working in the industry between 2018 and 2021; hence, these three types of ownership will be crucial for women's participation across the whole industry. Figure 8 shows the evolution of women's participation in the mining sector according to the type of mining company ownership:

Figure 4. Evolution of women's participation in Chile's mining workforce by type of ownership (2018-2021)


Source: Authors' estimate based on information obtained from SERNAGEOMIN.
Figure 8 shows a steady increase in women's participation in each type of ownership under consideration. National companies reflect the highest participation rate in 2021 (10.8\%), followed by international companies (10.5\%) and state-owned companies (10.1\%). Looking at this evolution, national companies represent the highest increase in participation, with 3 percentage points, followed by state-owned companies, and international companies.

Taking into consideration that this analysis includes large companies, these findings seem to confirm the assumption that large mine sites tend to promote the increase in women's participation, and that any type of change in these companies will change the participation rate of women across the mining sector.

### 3.6 Analysis by Support Services Companies

Women are distributed in a heterogeneous manner across the different occupations at a mine site. For that reason, we consider it relevant to analyze women's participation rate in support activities for the mining sector (including hotel, cleaning, and food services) through the analysis of two companies from our database: Aramark and Sodexo.

Figure 9 shows women's participation rate in the labour force of this type of company as compared to total number of women employed in the mining sector according to this database.

Figure 5. Evolution of women's participation in Chile's mining workforce - mining companies and mining support service companies (2018-2021)


Source: Authors' estimate based on information obtained from SERNAGEOMIN.
As reflected in Figure 9 above, between 2018 and 2021, 22,625 women were employed in the mining sector on average, of whom 19,390 worked in mining companies, whereas 3,235 worked in cleaning, food, and hotel support companies. These mining support companies represented $14 \%$ of the total amount of female workers on average, which means that the participation rate has increased since 2018 , when it represented $13 \%$. This information is considered relevant because, according to this database, most female jobs in this industry are concentrated in mining companies.

On the other hand, Figure 10 allows us to analyze the evolution of women's participation vs the total number of jobs in mining support companies:

Figure 6. Evolution of women's participation in Chile's mining workforce in mining support companies (2018-2021)


Source: Authors' estimate based on information obtained from SERNAGEOMIN (2021).
According to Figure 10, the participation rate of women in cleaning, food, and hotel support companies was $50 \%$ on average between 2018 and 2021. In addition, women's participation in mining companies was about $8 \%$. This difference reinforces the heterogeneity of women's presence with a higher participation at mine site canteens and a significant lower rate in mine operations.

### 3.7 Analysis by Occupations

In this section, women's participation will be analyzed considering different types of occupations. For this portion of the analysis particularly, the study "The Workforce for 2019-2028 Large-Scale Mining in Chile: Diagnosis and Recommendations" (CCM, 2019) identifying the challenges regarding human capital necessary in mining in the future and projecting the supply and the demand for each type of occupation is used.

Data for this study was collected from a sample of 13 mining companies employing 43,942 persons and 17 supplier companies employing 17,336 persons. According to data obtained from SERNAGEOMIN, the total size of the sample represents about $25 \%$ of the total population of mining workers by 2019. The study provides relevant information regarding women's participation in different occupations of the main value chain in mining.

Considering survey answers, the study makes staffing projections, including corresponding occupations. Table 3 shows a description of the profiles, the participation rate within the total number of employees, and women's participation rate in each profile.

Table 1. Features of mining occupational profiles in Chile (2019)

| Occupation | Description | \% Total amount of employees | Women's participation |
| :---: | :---: | :---: | :---: |
| Geologist | University professional with a licentiate degree in Geology; working in the Main Value Chain (MVC), in extraction or exploration activities. | 1 \% | 23 \% |
| Site mining professional | Professional university programs with or without a licentiate degree; working in operational management (operation). Specialty field: Mining Civil Engineering, Mining Field Engineering, Extractive Metallurgy, and Industrial Engineering. | 1 \% | 10 \% |
| Processing professional | Operational management; university professional with a licentiate degree; Specialty field: Metallurgy and Chemistry. | $1 \%$ | 15 \% |
| Maintenance professional | University professional with a licentiate degree, working in (operational) maintenance management. Specialty field: Electrical Mechanics, Electromechanics, Instrumentation, and Industrial Electronics. | 2 \% | 7 \% |
| Site mining specialist engineer | University professionals with a licentiate degree; working in operational management. Specialty field: Mining Civil Engineering, Mining Field Engineering, Extractive Metallurgy, and Industrial Technical Engineering. | 1 \% | 12 \% |
| Processing specialist engineer | University professionals with a licentiate degree; working in operational management, processes, control, and planning. Specialty field: Chemical Metallurgy. | 1 \% | 20 \% |
| Maintenance specialist engineer | University professionals with a licentiate degree; and technicians, working in operational management. Specialty field: Mechanics, Electricity, Electromechanics, Instrumentation, Electronics and Industrial Fields. | $6 \%$ | $9 \%$ |
| Site mining supervisor | Supervisors, Heads, Managers, Operators: working in mining operations. Professionals with or without a licentiate degree; university or technical professionals. | $4 \%$ | 6\% |
| Processing supervisors | Supervisors, Heads, Managers, Operators: working in mining operations. Professionals with or without a licentiate degree; university or technical professionals. | 1 \% | 10 \% |
| Maintenance supervisor | Supervisors, Heads, Managers, Operators: working in mining operations. Professionals with or without a licentiate degree; university or | 5 \% | 4 \% |


| Occupation | Description | \% Total <br> amount of <br> employees | Women's <br> participation |
| :--- | :--- | :--- | :---: |
|  | technical professionals. Specialty field: <br> Mechanics, Electricity, Electromechanics, <br> Instrumentation, and Electronics. |  |  |
| Other geology- <br> related <br> occupations | Development of mine workings (exploration, <br> construction), technological skills, software, <br> professional and technical fields. Specialty <br> field: Geological Surveying, Topography, and <br> Geology. | $1 \%$ | $10 \%$ |
| Operators of <br> mobile <br> equipment | Machine operation. Technical professional <br> education through training (extraction and <br> other processes). | $19 \%$ | $8 \%$ |
| Operators of <br> fixed equipment | Processing: machine operation. Technical <br> professional education through training. | $13 \%$ | $6 \%$ |
| Mechanical <br> maintenance | Maintenance: machine operation. Technical <br> Training Centres (TTC). Specialty field: <br> Mechanics, Electromechanics, Industrial | $36 \%$ | $2 \%$ |
| Maintenance, Maintenance of Heavy |  |  |  |
| Equipment. |  |  |  |

Source: Developed by the authors based on CCM (2019).
Table 3 shows that the labour participation of women is lower in mining occupations, which is where most of the mining workforce is concentrated. Occupations related to supervision, operation, and maintenance correspond to $87 \%$ of the total workforce in 2019. However, the occupations with the lowest levels of women's participation, in 2019, correspond to maintenance and extraction; that is, the works that are actually carried out at the mine. The lowest levels of women's participation are in the following occupations: mechanical maintainers (2\%) and electrical maintainers (4\%), maintenance supervisors (4\%), extraction supervisors (6\%), operators of fixed equipment ( $6 \%$ ), and operators of mobile equipment (8\%). Thus, we may conclude that this may be reason for the low participation of women in the work carried out in mine operations during this period. These mine occupations require a lower education level than other occupations; for maintainers and operators, most employees have an education level of up to secondary school and have undergone specific technical training. However, supervisors usually have higher education, either technical or university education, whereas employees in professional maintenance occupations are mostly university professionals.

On the contrary, the occupations with a lower number of staff have higher participation of women. Geology-related occupations, as well as professional and engineering
occupations, add up to $13 \%$ of the total staff. In 2019, the analysis showed that the occupations with women's participation exceeding 10\% are Geology (23\%), Processing Professional (15\%), Extraction Specialist Engineer (12\%), and Processing Specialist Engineer (15\%), apart from other Geology-related occupations (10\%). These are the occupations that require a higher education level, mainly a university level.

The study allows us to analyze the evolution of women's participation in these different occupations. Figure 11 shows the evolution in women's participation divided by: Operations and Maintenance; Supervision; Types of Engineering and Geology; and Other Professional Occupations.

Figure 7. Participation rate of female mining workers by occupation (2012-2019) ${ }^{6}$


Source: Developed by the authors based on information obtained from CCM (2019)
Considering operations and maintenance, an increase is observed during the period studied in all the occupations analyzed, with the exception of Mechanical Maintenance and Electrical Maintenance. It is important to note that, according to the study from which the data is derived, the occupations that would have the highest cumulative demand by 2028 would be Mechanical Maintainer, Operator of Mobile Equipment, and Operator of Fixed Equipment; that is, occupations with a women's participation rate lower than $10 \%$.

[^5]This is particularly relevant considering that these occupations are carried out at the mine site, and they are typically provided to local workers.

Supervision occupations also reflect an increase in women's participation during the period under consideration, particularly as from 2015. It is important to underline that, in 2019, Processing Supervision showed a significantly higher participation rate than Extraction Supervision (4\%) or Processing Supervision (6\%).

When considering the Engineering branches, women's participation has also increased during the period under analysis and, on average, is higher than in the Maintenance and Supervision occupations. It is also interesting to see that women's participation is significantly higher in the Processing area (and the same applies for female Supervisors) than in the Extraction (12\%) and Maintenance (9\%) areas.

In the case of Geology and other professional activities, participation rates are higher on average and also have increased over time. In particular, there is a high rate of women's participation in occupations related to Geology and Processing, which contrasts with the participation rate in occupations related to Extraction and Maintenance.

In conclusion, the analysis points out where the greatest efforts should be placed in order to increase women's participation in mining. It is important to emphasize that the tasks related to Maintenance and Operation, with specific training in the field of Mechanics, Electronics and Electricity, are the occupations in the main mining value chain with the highest projected demand by 2028 (CCM, 2019). These are also the occupations with the lowest women's participation in the industry and with the widest gaps between the number of qualified students, as shown in the following section, and the projected demand for required employees; therefore, the training of women in these areas is a medium-term strategic challenge. In addition, women's participation is lower in those occupations demanding a lower education level, so efforts aimed directly at technical training for women could have a significant impact on integrating women into the main value chain of the industry.

### 3.8 Analysis by Educational Level and DecisionMaking Positions

This section will analyze women's participation in Chile's mining sector by educational level and positions of power. To that end, data from the study "The Workforce for 20192028 Large-Scale Mining in Chile: Diagnosis and Recommendations" (CCM, 2019), and its version for 2021-2030 (CCM, 2021) was used. ${ }^{7}$

[^6]As for educational level by position, data on all female workers in mining companies for different occupational tiers for 2018-2020 published by CCM (2021), was used. This data shows the education level of women in different occupations along the value chain. Figure 12 shows an increasing overall average of $22 \%$ in all occupations requiring higher technical and professional training. It also shows that the most remarkable change in terms of education level is in the group of female supervisors, with a difference of 34 percentage points compared to vocational and university education over the 2 years considered; thus, the conclusion is that for supervisory positions, the most representative education level for 2020 is vocational technical education. Something similar is observed in maintenance positions. The percentage of women with higher technical education increased by 19 percentage points, suggesting a higher level of women with professional training in this category of workers. In addition, it could be assumed that mining companies are looking for more qualified women to perform jobs in this occupational group. In the operator occupational group, the percentages of women's participation remain stable, leading to the conclusion that women have kept their positions, and their levels of education have not changed. Here there is an opportunity for mining companies to improve and provide more vocational training and higher education opportunities for this population of women.

Figure 8. Percentage of education level of women by occupational group in mining companies 2018-2020


Source: Compiled by the authors based on CCM (2021). ${ }^{8}$
Now, based on the studies by CCM in 2019 and 2021 (its version for 2021-2030) total female workforce and women's participation in decision-making positions in large-scale mining are analyzed to estimate the participation of women in positions of power. Based on these data, Figure 13 analyzes the trend in women's participation in each of the

[^7]occupations over a 4 -year period. The findings suggest that supervisor positions grew by more than $100 \%$ ( +5.1 percentage points) having the greatest increase in women's participation in this period, followed by the managerial sector, with a positive percentage change of $80 \%$, from $9.4 \%$ in 2017 to $16.9 \%$ in 2020 ( +7.5 percentage points). Women's participation in managerial and deputy manager/superintendent positions increased $73 \%$ and $25 \%$, respectively, ( +6.6 and +2.5 percentage points), during these years.

Figure 13. Percentage of women in decision-making positions


Source: Compiled by the authors based on CCM (2019-2021).
Therefore, a general increase in women's participation in positions of power in the mining industry is observed. For 2020, all occupations show an increase compared to previous years; some negative changes are observed in some years, but they were corrected in later years, resulting in the fact that, according to these studies, occupations in relevant and decision-making positions have a higher women's participation than mining as a whole in 2020 (9.4\%).

### 3.9 Professional Offer for Women

This section analyzes the educational offer and the enrollment of women in professional programs required for the development of mining. This analysis is based on the figures reported by Chile's Ministry of Education on the number of higher education graduates, which are later segregated by gender and profession. Data from 2010 have been used to observe changes in women's participation in each higher education program.

Figure 13 shows the total number of female graduates in the decade 2010-2020, that is to say, a total of 62,809 women were trained and graduated in professions relevant to the mining industry.

As mentioned above, 27,715 women are working in the mining industry in 2021 (SERNAGEOMIN 2021). However, not all of them have technical and/or professional educational level; as mentioned above and according to the estimates derived from the data from the study The Workforce for 2021-2030 Large-Scale Mining in Chile (CCM, 2021), by 2020 only about $57 \%$ of women had vocational and/or professional studies. Therefore, projecting the same trend for 2021, only $25 \%$ of female professionals and technicians graduated in the period 2010-2020 will be working in activities related to the mining industry. This shows a remarkable gap in the ability of women to enter the mining sector after professional or technical training. ${ }^{9}$

Figure 9. Female higher education graduates 2010-2020


Source: Compiled by the authors based on data from the Ministry of Education (2020).
Based on the database of Chile's Ministry of Education (2020) an analysis is made on the evolution of women's participation in traditionally male-dominated high education programs.

This study distinguished between two types of women's participation (high and low), both in professional and technical programs. For a women's participation range to be

[^8]considered high, the share of female graduates should be greater than $30 \%$, any share lower than this is considered low.

Therefore, Figure 15 A . describes a growing trend in Geology and a more consistent upward trend in Risk Prevention Engineering. On the other hand, we see that Chemical Civil Engineering has not increased during the period under consideration and that Environmental Civil Engineering has evolved from being a predominantly female career in 2010 to a predominantly male program in 2020 . It is worth noting that average participation rate for women in these programs during the decade analyzed is $44 \%$, leading to the conclusion that, although there is a high participation rate, male presence predominates in all professional programs. In addition, when analyzing the last 5 years, a decreasing trend is observed in women's participation in programs such as Environmental Civil Engineering, with a drop of 19 percentage points; however, in other programs, the variation is lower and the downward trend is constant, leading us to conclude that the gap between men and women with specific qualifications for the mining sector is becoming larger, cementing male domination in these professions in Chile..

Figure 15. Women's participation in professional programs
A. High participation


## B. Low participation



Source: Compiled by the authors based on data from the Ministry of Education of Chile (2020).
Now, having determined the ranges to classify women's participation, Figure 15B reflects certain specific occupations highly relevant to the mining industry having a low participation of women. Most of these occupations are traditionally male-dominated in Chile. Thus, we consider that women's interest has been increasing throughout the decade, and the trend has been positive, with growth rates ranging from $15 \%$ to over $180 \%$. In addition, a significantly higher women's participation within this industry is observed for Mining Civil Engineering (+13 percentage points) and Mining Engineering (+8 percentage points) programs. Other higher education programs had positive variations, but their growth is slowing down, leading to the conclusion that there is a lack of motivation among women to enroll in these types of programs. Electronic Civil Engineering is the only program in which the participation of women has decreased over
the decade, confirming the overwhelming presence of men in occupations related to this engineering branch in the mining industry.

The above analysis leads to the conclusion that education and enrollment incentives should be created to encourage women to pursue these types of programs, especially Electronic Civil Engineering and Mechanical Engineering, with related positions mostly being filled by men.

Figure 16. Women's participation in technical programs

## A. High participation


B. Low participation


Source: Compiled by the authors based on data from the Ministry of Education of Chile (2020).
Following the analysis of female enrollment in technical programs, Figure 16A shows an increasing trend in enrollment rate for the decade 2010-2020. Specifically, Logistics Technician and Risk Prevention Technician programs have an average female enrollment over the decade of $62 \%$ and $47 \%$, respectively and are the technical programs most sought after by women entering the mining industry. Geomining Technician, Chemistry Technician, and Geology Technician programs have an average female enrollment over the decade of $39 \%, 30 \%$ and $27 \%$, respectively. However, when analyzing the last 5 years, we find a decreasing trend in female enrollment, with Geomining Technician showing the steepest drop, from a $48 \%$ female enrollment to $32 \%$ ( -16 percentage points); thus, becoming a predominantly male career. Chemical Technician programs had negative variations ( -6 percentage points). However, this is the only program as of 2020 where women's enrollment is higher than men's.

Figure 15 B , which analyzes the technical programs with low female enrollment, shows that Industrial Electricity Technician and Industrial Maintenance Technician programs show an increase over the period. However, both programs continue to have extremely low female enrollment rates (below 4\%). For Industrial Control Technician, the level of enrollment has remained the same over the decade. The average female enrollment rate in the decade is $4 \%$, thus reflecting a broad masculinization of these technical programs
and poses a challenge for the government and the private sector to create incentives for more women in Chile to access and be interested in these types of technical programs.

The authors consider that female enrollment should be increased in all these programs through scholarships or quotas for women interested in the mining industry, as this could allow an increase in women's participation in most male-dominated (low women's rate) occupations within the industry, as in areas of mechanical maintenance (2\%), electrical maintenance (4\%), and maintenance supervision (4\%). This could also be achieved through training programs focused on women within the mining industry, ideally in the same region where the mine is located, so that women can have the technical knowledge required to perform in those occupations that are the most challenging for integrating women into Chile's mining industry.

### 3.10 Pay Gaps

This section analyzes data from the 2020 Chile Socioeconomic Characterization Survey (CASEN) conducted by the Ministry of Social Development to identify gender gaps by occupation and payment.

The data from this survey allows the identification of workers in mining companies by gender, occupation, hours of work, and compensation. With this information, we can analyze whether there are gender gaps in hourly wages by occupation, i.e., we can analyze the compensation received by women working in the mining industry. It is worth noting that the survey was targeted to a limited sample population, and the analysis can only be performed for occupations for which information is available. Therefore, the occupations that have all the necessary data to perform the pay gap analysis are i) Engineering, with 202 persons ( 178 men, 24 women); ii) Miners category, with 114 persons included ( 108 men, 6 women); and iii) Cleaning and Restaurants category, with 43 persons ( 30 men, 13 women).

Figure 17. Pay gaps


Source: Compiled by the authors based on CASEN (2020).
Thus, applying survey data, Figure 17 was created and shows a large pay gap between men and women exists in all occupations. Notably, in the Cleaning and Restaurant category, women were paid $49.7 \%$ less than men in 2020, being the highest pay gap in Chile's mining industry. In addition, there is a significant pay gap between men and women in the miners' category, which is the main basic activity of the mining industry. This difference of $17.9 \%$ confirms that women in mining do not have the same economic benefits. Therefore, the mining sector should create pay equity strategies. Although for professional occupations, the pay gap is not so marked (5.8\%), the pay gap is still significant in terms of pay inequality in Chile's mining sector. This wage differential may become a disincentive for more women to enter or become interested in activities in the mining industry.

### 3.11 Government Expenditure

Based on data on total central government expenditures for 2019 downloaded from the online platform of the Fundación Observatorio Fiscal, a total of 804,000 million Chilean pesos (USD 933,556,560 - Dec 2022) was allotted to R\&D, equivalent to $0.4 \%$ of GDP. This would be in line with, albeit somewhat above, data from the World Bank's platform stating an R\&D expenditure equivalent to $0.36 \%$ of GDP for 2017. Assigning considerably less than $1 \%$ of GDP on research and development is considered a low level of expenditure. Increasing research is a challenge for the development of the country. The theories on endogenous economic growth indicate that positive externalities generated by research boost economic growth.

Although there is no updated data, we can conclude that, according to the study Education at a Glance 2019: An analysis of the most relevant results for Chile published by the Ministry of Education in 2019, Chile's expenditure on primary and secondary education is $3.6 \%$ of GDP, which is slightly above the $3.5 \%$ of OECD countries. Out of this
$3.6 \%, 3.0 \%$ comes from government resources. In addition, regarding Chile's education funding, the data in this study reflects a percentage gap in the amount of resources per student allotted between Chile and OECD countries: see Table 4. This demonstrates the need for greater government investment in education.

Table 2. The gap between Chile and OECD countries in expenditure per student by type of education program in 2017*

| LEVEL | CHILE | OECD | BRECHA | \% BRECHA |
| :--- | ---: | ---: | ---: | ---: |
| Kindergarten | 6.908 | 8.605 | 1.697 | $19,7 \%$ |
| 1st to 6th Grade Primary School | 5.371 | 8.470 | 3.099 | $36,6 \%$ |
| 7th to 8th Grade Primary School | 5.556 | 9.884 | 4.328 | $43,8 \%$ |
| Scientific-Humanistic High School | 5.031 | 9.387 | 4.356 | $46,4 \%$ |
| Technical High School | 5.432 | 10.922 | 5.490 | $50,3 \%$ |
| Higher Education (excluding R\&D) | 9.271 | 11.056 | 1.785 | $16,1 \%$ |

*(Values in USD)
Source: Prepared based on data from the Ministry of Education (2019): Education at a Glance 2019.

Now, as for the areas of education that are preferred by students on initial professional programs, the study shows that $30 \%$ choose careers related to Science, Technology, Engineering, and Mathematics (STEM), compared to $27 \%$ in OECD countries.

Particularly for STEM education programs, the study shows that participation is lower among women in Chile but tends to increase with higher levels of education. Specifically, technical programs in STEM higher education have $12 \%$ female enrollment, compared to $22 \%$ in professional programs. Compared to OECD countries, the percentage of female enrollment corresponds to $20 \%$ and $30 \%$, respectively.

### 3.12 Data Gaps and Inconsistencies

Significant gaps: We do not have access to payroll data with individual wages; this data would have allowed identifying gender gaps more specifically than above.

Likewise, we do not have access to payroll data by educational level of individual workers, only aggregate numbers by gender, company, and mine site; individual characteristics are not available.

There are no significant discrepancies between global women's participation in mining as estimated by the authors and as published by SERNAGEOMIN.

### 4.0 CURRENT CONDITIONS OF WOMEN IN MINING

### 4.1 Introduction

This section will analyze the current status of women in Chile's mining industry from the perspective of public policies and perceptions of women's conditions in the industry. An analysis of women's workforce participation in general and women's condition during the COVID-19 pandemic is included.

### 4.2 Gender Focus From the Perspective of Public Policies

From the perspective of public policies and specific guidelines for the inclusion of women in economic activities, in 2012 the Ministry of Labor and Social Security, through the SENCE (National Training and Employment Service), and the Ministry of Mining, implemented the Program Woman Miner Training, aimed at fostering female inclusion in Chile's mining workforce. This initiative sought to promote women's employability by facilitating opportunities for women's training and participation in the mining sector. As a result, a growing trend is seen, with women's participation climbing up to more than 27,000 women (SERNAGEOMIN, 2021). These numbers reflect how, over the last 10 years, Chile has experienced an increase in job offers for women in mining.

Subsequently, and to strengthen women's participation in the mining industry, in 2017, the Ministry of Mining, the Undersecretariat of Women and Gender Equality, and representatives from the mining industry signed on to the Mining Industry Guidelines to promote the participation of women in the sector and to promote the balance among professional, familiar, and personal life. ${ }^{10}$ The main goals of these guidelines were

[^9]promoting and developing adequate working conditions for men and women and increasing women's participation and presence in decision-making positions in the mining industry.

In addition to the above, and to improve opportunities for women in Chile's mining industry, the government, through its public policies, has implemented different initiatives and guidelines, such as the NCH 3262-2021 Standard, Gender Equality Management System and Conciliation of Work, Family and Personal Life, a management tool that sets gender inclusion requirements for organizations (SERNAMEG, 2021). Also, the Woman and Mining Roundtable, led by the Ministry of Women and Gender Equality and the Ministry of Mining, implemented the Best Gender Practices for the Mining Sector 20182020 including a series of specific actions to promote women's participation in the sector. ${ }^{11}$

Strengthening gender-oriented public policies is an ongoing challenge in Chile; the implementation of guidelines, regulatory frameworks, and specific policies for female inclusion in the mining industry is key to workforce diversity. Some companies recognize that employing more women has competitive advantages, can increase profitability, and better results are obtained with mixed teams.

The inclusion of women in the mining sector is strategic; breaking down barriers and stereotypes, the industry would become a transformational example of change, with actions or initiatives being replicated and standardized in other economic areas, thus increasing women's inclusion and participation in other productive sectors of the economy (Stefanovic and Saavedra, 2016).

[^10]
### 4.4 Women's Conditions in Chile's Mining Sector

The Ministry of Mining, in 2016, commissioned a survey titled "Study for the Characterization of Women in the Mining Industry: Barriers and Challenges" (Rojas C; 2016). Different issues relevant to female workers were addressed in the study. Among the main findings of this study are the main barriers encountered for joining and staying in the industry, which range from discrimination in recruitment processes, lack of basic infrastructure (e.g., toilets), underestimation of female physical traits for normal tasks, and lack of career development, to the absence of women in operative and maintenance roles. ${ }^{12}$ Also, through quantitative analysis, some findings related to the work/life balance, direct or indirect discrimination, sexual harassment and equity are observed.

The main findings of the study include:

- In terms of work/life balance, $36 \%$ of women stated that the organization fails to apply the necessary policies to balance both aspects. When asked about access to nurseries, a similar number was observed, with $38 \%$ of women answering that their organization did not have a nursery for all. Concerning time flexibility for personal matters, $43 \%$ stated that their organization was not flexible about time for personal or family matters. Also, when asked about work conditions that create work-related stress, $65 \%$ answered that there were stressful conditions in their organizations. Likewise, on discrimination at the workplace, $31 \%$ of women stated they felt being discriminated against in the mining industry, and a similar proportion, $33 \%$, stated they had observed acts of discrimination against women.
- Another important finding referred to the recruitment processes was that $67 \%$ of the participants stated that, at the moment of joining the company, they were asked about their marital status and number of children. 11\% answered feeling discriminated against for being a woman during the recruitment process. Besides, in connection with sexual harassment at the workplace, $45 \%$ of the women surveyed stated they have experienced double entendres. Also, the study showed that $29 \%$ of the women received comments on their bodies; $28 \%$ felt they were stared at as sexual objects; $20 \%$ were greeted in a way that was unacceptable for them (hugged or kissed on the cheek); 19\% answered being grabbed by the waist or shoulders without consent; and $4 \%$ as receiving obscene gestures. In addition, $23 \%$ indicated they were asked out without being interested, and $7 \%$ indicated they received propositions to have an intimate relation.
- Particularly on the subject of Equitable Work Conditions, $45 \%$ stated that women's salaries in same responsibility positions are not on a par with men. $49 \%$ expressed that the salary scales were not known by all employees (both men and women). Moreover, $35 \%$ stated there was not any clarity or transparency in recognition and

[^11]assessment criteria, and $26 \%$ stated that benefits are discriminatory against women.

In addition to the study above, the School of Economics and Business of the University of Chile and the ONG Women in Mining Chile (WIM) launched a study titled "Women and Mining 2022. Barriers and Challenges for the Incorporation and Development of Women in the Mining Industry" with the objective of providing current data on working conditions of women in mining, and of identifying actual practices that affect the incorporation, development and permanence of women in mining. As part of the study, a total of 1,367 women in the mining industry were interviewed individually and in focus groups.

Below are the main findings of this study:

- In terms of gender discrimination, $69 \%$ of the women workers stated there are discriminatory practices, whereas $41 \%$ stated they have observed these types of situations. On salaries and benefits, $37 \%$ answered they have witnessed discriminatory practices, whereas $53 \%$ stated that sexual jokes were made at their workplaces (both by men and women), and $32 \%$ indicated they witnessed discriminatory practices in their work teams.
- Regarding sexual harassment, $32 \%$ stated they have experienced double entendres, whistling, and catcalling; $31 \%$ stated receiving comments on their bodies; and $23 \%$ felt uneasy about a physical interaction. Similar percentages were found on invitations to go out (23\%), observed sexual harassment (24\%), inappropriate sexual gestures towards women (23\%) and fear of harassment (21\%). Concerning obscene gestures, $7 \%$ of the female workers stated they have experienced them.
- In terms of work/life balance, $57 \%$ indicated they were too tired after work to do something they liked, whereas $55 \%$ stated that they did most of the housework. However, $59 \%$ stated they were satisfied with the amount of time dedicated to work, and the same number stated that their work was compatible with their personal/family life, whereas $46 \%$ stated they were satisfied with the time they dedicated to their family/friends.
- In terms of career development and work stability, 33\% stated they have experienced hostility for being women, whereas $26 \%$ stated feeling gender-based work instability. Also when considering career development, $34 \%$ stated that men and women do not have equal opportunities of promotion to positions of higher responsibility and leadership at work, whereas $32 \%$ stated they have not been able to develop their careers into leadership positions. $30 \%$ also stated that women's careers are not promoted to positions in the value chain at their workplace, and that men and women do not have the same opportunities for career development.

Based on the data, we found that women in the mining industry still face multiple barriers, from educational to organizational, and normalization of certain behaviours that are directly or indirectly discriminatory against them. However, progress in public policies,
together with improvements in organizational practices in the mining sector, reflect a silver lining not only for the incorporation of a larger number of women, but also for recruitment and retention processes.

### 4.5 Women's Participation in the Labour Force and COVID-19 Pandemic Impact

In order to better understand women's participation in Chile's mining workforce, female inclusion in Chilean workplaces as a whole should be considered.

Women's participation in Chile's workforce is one of the lowest in the OECD and Latin America, despite Chile's economic growth and women's high schooling level. This situation has become known as the Chilean Exception (Contreras et al. 2012). Increasing women's participation is therefore a challenge, if we take into account that "women's salaries improve income distribution, constitute a powerful tool to overcome poverty, and provide access to higher levels of individual and family economic well-being," and that "a larger workforce impacts the government budgets and increases the number of contributors to the pension system" and, for women, participating in the labour market "reinforces women's autonomy, breaks women's isolation and broadens women's emotional and cognitive horizons" (Rodríguez and Muñoz, 2015).

The Chilean Exception scenario has been intensified by the COVID-19 pandemic. The pandemic also created a crisis for caretaking, as nurseries and schools were closed, and an economic crisis due to the quarantines and the disruption of commercial routes and of the production of goods and services. As a consequence, it created extra tasks, particularly caretaking of children and elderly people, which were performed mostly by women. Besides the pandemic itself, the restrictions adopted for its mitigation mostly affected the sectors where there is a need for human interaction, such as social and commercial services, where most of the workforce is female. In Chile, women's participation in the workforce dropped to levels common prior to 2010, as seen in Figure 18.

Figure 10. Evolution of women's participation in the workforce


Source: Prepared by the authors based on the National Employment Survey 2020.
The health crisis came along with a caretaking crisis, due to population confinement conditions that required the closure of schools and nurseries; and this impacted women more than men. The Longitudinal Covid-19 Employment Survey: real-time data, published in September 2020, indicates that men dedicated zero (0) hours to their children's school chores, or to help other people at home, creating a gap of four (4) and five (5) hours respectively.

Consideration should be given to the fact that many people left their jobs due to the pandemic because they lacked the possibility to find balance between work and family or because jobs were destroyed (unemployment is not considered). This is observed in that "despite the reduction of 930000 female positions, the number of unemployed women increased to 18000 , whereas 910000 left the labor market" (Cerda et al. 2020). For the above, it is important to highlight the employment rates, which in the case of men, decreased by $17.3 \%$ and in the case of women, decreased by $23.5 \%$ according to Chile's National Employment Survey.

Therefore, Chile faces a significant challenge in increasing women's participation in the labour market. This, together with the multisystemic crisis caused by the COVID-19 pandemic, constitutes a scenario of double opportunity to plan public policies and approach the economic recovery from a gender perspective. As there is a lot of room for increasing women's participation, the effects of accomplishing this goal are potentially very important in terms of inequality, poverty, autonomy and empowerment of women which, in the long run, will change heavily masculinized cultural patterns.

### 5.0 GENERAL CONCLUSIONS AND CHALLENGES

The mining industry has traditionally been dominated by men, which has led to unfavourable conditions for women trying to join this industry in Chile. However, the last decades have seen the implementation of several initiatives to promote women's inclusion in the industry.

Despite the increased number of women working in Chile's mining industry, rising from $6.16 \%$ in 2010 to $10.06 \%$ in 2021 (SERNAGEOMIN, 2021), women's share continues to be very low compared to men's. Note that many women working in the sector hold administrative or support positions, and not technical or leadership roles.

It is important to highlight that larger mining projects push women's participation up, and changes or impacts in this tier will affect women's participation across the industry.

The lack of gender diversity in the mining industry is not just an issue of social justice, but it also has economic and commercial implications. Evidence suggests that the inclusion of women in leadership and decision-making positions can lead to better corporate results and to more innovation. Some mining companies acknowledge that incorporating more women has competitive advantages, can increase profitability, and that better outcomes are obtained with mixed teams.

Despite the progress in women's participation in the mining industry shown by the analyses mentioned in Sections 3 and 4, there are still significant challenges to women's participation in Chile's mining sector. One of the main challenges is the persistence of gender stereotypes and masculinized attitudes that frequently hinder women's progress. Besides, the lack of infrastructure and services in the mining areas often makes it harder for women to find lodging and childcare services.

In conclusion, although many advances have been made for including women in the mining sector, there is still a lot to do. Broader policies are needed to approach gender gaps in the industry, such as the elimination of gender-based barriers and stereotypes, promotion of more inclusive work practices, and creation of networks and associations to support women working in the industry. Only through increased women's participation in the mining sector can mining economic and corporate advantages be fully leveraged.

Our analysis of the challenges to be overcome is detailed below:

1. With respect to the barriers to women's participation in mining, in terms of education, we observe that some institutions have recently started to become aware of this gap and are monitoring statistics in order to take concrete action.
2. When considering barriers to women's participation within mining organizations, we consider there are indicators of sexual harassment, a feeling that women are
subject to greater demands, discriminated against in recruitment and selection processes, have fewer opportunities for development and less access to higher management positions.
3. Identified cultural barriers, such as men's "underestimation of female physical traits for normal tasks" originate in the masculinized work culture rooted in the sector. Throughout history, this belief has limited the incorporation and retention of women in mining activities, relegating them as homemakers, under the allegation that they could not endure the hard, extended work shifts in the industry (Klubock, 1996; Rojas, 2014; Salinas and Barrientos, 2011; Sagredo and Gazmuri, 2005).
4. For the above, parenting is considered a female responsibility, and women are discriminated against for this reason. On the assumption of women's weakness, they have been placed mostly in back-office positions (HR, administration, prevention, cleaning and kitchen staff) where physical strength is not an important factor.
5. Gender stereotypes observed during this research are also an important barrier, for example, women's technical input is overshadowed by their social skills (such as conflict resolution).

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## ANNEXES

Table 1A. Workers (men and women) at mine sites

|  | Total workforce |  |  | Women |  | Men |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Year | Total | \% Variation | Total | Percentage | \% Variation | Total | Percentage |
| 2010 | 191.043 |  | 11.760 | 6,16 |  | 179.283 | 93,84 |
| 2011 | 197.197 | 3,2 | 12.557 | 6,37 | 3,4 | 184.640 | 93,63 |
| 2012 | 236.771 | 20,1 | 17.205 | 7,27 | 14,1 | 219.566 | 92,73 |
| 2013 | 229.375 | $-3,1$ | 17.061 | 7,44 | 2,4 | 212.314 | 92,56 |
| 2014 | 249.815 | 8,9 | 18.918 | 7,57 | 1,8 | 230.897 | 92,43 |
| 2015 | 238.454 | $-4,5$ | 18.839 | 7,90 | 4,3 | 219.615 | 92,10 |
| 2016 | 218.160 | $-8,5$ | 17.482 | 8,01 | 1,4 | 200.678 | 91,99 |
| 2017 | 217.404 | $-0,3$ | 17.615 | 8,10 | 1,1 | 199.789 | 91,90 |
| 2018 | 228.340 | 5,0 | 19.284 | 8,45 | 4,2 | 209.056 | 91,55 |
| 2019 | 248.803 | 9,0 | 21.455 | 8,62 | 2,1 | 227.348 | 91,38 |
| 2020 | 234.964 | $-5,6$ | 22.045 | 9,38 | 8,8 | 212.919 | 90,62 |
| 2021 | 275.575 | 17,3 | 27.715 | 10,06 | 7,2 | 247.860 | 89,94 |
| Average | 234.078 | 3,8 |  | 1,63 | 4,6 |  |  |

Source: SERNAGEOMIN (2021) Anuario Estadístico [Statistics Yearbook] 2021

Table 2A. Women's participation by mine size

| Category | TOTAL Workers | \# Mine Sites | Average Participation |
| :--- | :--- | :--- | :--- |
| Small, 2018 | 83472 | 382 | $5,57 \%$ |
| Small, 2019 | 72515 | 356 | $5,57 \%$ |
| Small, 2020 | 74074 | 324 | $5,75 \%$ |
| Small, 2021 | 76335 | 321 | $6,31 \%$ |
| Medium-sized, 2018 | 79797 | 16 | $8,78 \%$ |
| Medium-sized, 2019 | 86527 | 19 | $9,26 \%$ |
| Medium-sized, 2020 | 79075 | 17 | $9,95 \%$ |
| Medium-sized, 2021 | 82219 | 18 | $10,58 \%$ |
| Large, 2018 | 65008 | 4 | $8,49 \%$ |
| Large, 2019 | 87617 | 7829 | 6 |

Source: SERNAGEOMIN (2021) Statistics Yearbook 2021
Table 3A. Workforce by company type and women's participation

|  | Fuerza Laboral |  |  |  | Empresas Mineras |  |  |  | Empresas de Soporte (Sodexoy Arimax) |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Hombres | Mujeres | Total | Participació n \% <br> Femenina | Hombres | Mujeres | Total | Participación \% Femenina | Hombres | Mujeres | Total | Participación \% Femenina |
| 2010 | 179.283 | 11.760 | 191.043 | 6,2\% |  |  |  |  |  |  |  |  |
| 2011 | 184.640 | 12.557 | 197.197 | 6,4\% |  |  |  |  |  |  |  |  |
| 2012 | 219.566 | 17.205 | 236.771 | 7,3\% |  |  |  |  |  |  |  |  |
| 2013 | 212.314 | 17.061 | 229.375 | 7,4\% |  |  |  |  |  |  |  |  |
| 2014 | 230.897 | 18.918 | 249.815 | 7,6\% |  |  |  |  |  |  |  |  |
| 2015 | 219.615 | 18.839 | 238.454 | 7,9\% |  |  |  |  |  |  |  |  |
| 2016 | 200.678 | 17.482 | 218.160 | 8,0\% |  |  |  |  |  |  |  |  |
| 2017 | 199.789 | 17.615 | 217.404 | 8,1\% |  |  |  |  |  |  |  |  |
| 2018 | 209.056 | 19.284 | 228.340 | 8,4\% | 206.410 | 16.802 | 223.212 | 7,5\% | 2.646 | 2.482 | 5.128 | 48,4\% |
| 2019 | 227.348 | 21.455 | 248.803 | 8,6\% | 224.259 | 18.243 | 242.502 | 7,5\% | 3.089 | 3.212 | 6.301 | 51,0\% |
| 2020 | 212.919 | 22.045 | 234.964 | 9,4\% | 209.755 | 18.848 | 228.603 | 8,2\% | 3.164 | 3.197 | 6.361 | 50,3\% |
| 2021 | 247.860 | 27.715 | 275.575 | 10,1\% | 243.884 | 23.667 | 267.551 | 8,8\% | 3.976 | 4.048 | 8.024 | 50,4\% |

Source: SERNAGEOMIN (2021)

Table 4A. Workforce per zone, region and gender

| Zone | Region | Province | Men | Women | Total | \% Women's Participation |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Norte Grande | Arica y Parinacota | Arica | 1140 | 90 | 1230 | 7,3 |
|  |  | Parinacota | 361 | 16 | 377 | 4,2 |
|  | Tarapacá | Iquique | 2260 | 148 | 2408 | 6,1 |
|  |  | Tamarugal | 35366 | 3449 | 38815 | 8,9 |
|  | Antofagasta | Tocopilla | 4155 | 531 | 4686 | 11,3 |
|  |  | El Loa | 33488 | 4515 | 38003 | 11,9 |
|  |  | Antofagasta | 59589 | 7690 | 67279 | 11,4 |
| Norte Chico | Atacama | Copiapó | 21747 | 2258 | 24005 | 9,4 |
|  |  | Chañaral | 10399 | 893 | 11292 | 7,9 |
|  |  | Huasco | 4428 | 446 | 4874 | 9,2 |
|  | Coquimbo | Elqui | 5431 | 599 | 6030 | 9,9 |
|  |  | Limari | 1245 | 125 | 1370 | 9,1 |
|  |  | Choapa | 14076 | 1638 | 15714 | 10,4 |
| Central Region | Valparaíso | Petorca | 1385 | 125 | 1510 | 8,3 |
|  |  | Los Andes | 9247 | 845 | 10092 | 8,4 |
|  |  | San Felipe | 1468 | 222 | 1690 | 13,1 |
|  |  | Quillota | 1630 | 184 | 1814 | 10,1 |
|  | Metropolitana | Santiago | 52 | 2 | 54 | 3,7 |
|  | O'Higgins | Cachapoal | 16542 | 1553 | 18095 | 8,6 |
|  | Maule | Curicó | 82 | 0 | 82 | 0,0 |
|  |  | Talca | 110 | 4 | 114 | 3,5 |
|  |  | Linares | 9 | 3 | 12 | 25,0 |
|  | Bio Bio | Concepción | 20 | 3 | 23 | 13,0 |
|  |  | Arauco | 225 | 2 | 227 | 0,9 |
| South | South | Sur | 0 | 0 | 0 | 0,0 |
| Southern Region | Aysén | Coyhaique | 297 | 20 | 317 | 6,3 |
|  |  | General Carrera | 123 | 8 | 131 | 6,1 |
|  | Magallanes and Antártica | Magallanes | 253 | 35 | 288 | 12,2 |
|  |  | Última Esperanza | 71 | 0 | 71 | 0,0 |

Source: SERNAGEOMIN (2021)

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Sustainable Development


[^0]:    ${ }^{1}$ Consejo Minero (2022). Mining Industry Updated Figures. https://consejominero.cl/en/mining-in-chile/updated-mining-figures/

[^1]:    2 An industry is considered male-dominated if more than $80 \%$ of its workers are men (Consejo Minero, 2022).

[^2]:    ${ }^{3}$ Data from mine sites with fewer than 10 workers were removed from this analysis, and data up to July 2021 was used, leaving aside the last few months, since these month's figures will probably be corrected and modified in the future.

[^3]:    ${ }^{4}$ Provinces with fewer than 100 workers were removed from the analysis (Santiago, Linares, Concepción, Última Esperanza).

[^4]:    ${ }^{5}$ The companies included in each category are specified below: state-owned companies: CODELCO, ENAP, ENAMI; National companies: COMPAÑÍA MINERA DEL PACÍIFICO, ANTOFAGASTA MINERALS, PUNTA DEL COBRE, MINERA LOS PELAMBRES, SQM; International companies: SCM EL ABRA, TECK, CERRO COLORADO, ANGLOAMERICAN, MANTOS COPPER, COLLAHUASI, ALTONORTE, SPENCE, CANDELARIA, ALBEMARLE, ESCONDIDA, LOMAS BAYAS, TECK CARMEN DE ANDACOLLO, GOLD FIELDS SALARES NORTE, LUMINA, MERIDIAN, SIERRA GORDA.

[^5]:    ${ }^{6}$ There is no information available for 2016 and 2018.

[^6]:    ${ }^{7}$ In CCM 2019, the sample comprised 13 mining companies ( 43,942 persons) and 17 large-scale mining suppliers ( 17,336 persons). CCM 2021 (p. 8) included "14 mining companies and 13 supplier companies pursuing business in large scale mining, with a sample of 176,496 persons, out of which 46,412 are mine workers and 130,084 belong to supplier companies."

[^7]:    ${ }^{8}$ There is no information available for 2019.

[^8]:    ${ }^{9}$ This estimate is based on the number of women obtained from the percentage of women's participation by occupational group in the main value chain and on the percentage of women per educational level, taken from the study The Workforce for 2021-2030 Large-Scale Mining in Chile. It should be noted that only technical and university categories are used. Based on the above, the percentage of women with technical and university educational level for 2020 is calculated. From this information and the SERNAGEOMIN 2021 report, the number of women with university and technical studies for 2021 can be calculated. Now, using the above data and the information about females graduated from higher education, the percentage of female graduates working in jobs related to their academic studies can be calculated.

[^9]:    ${ }^{10}$ The commitments in the Guidelines (called Decálogo de la industria minera por la incorporación de mujeres y la conciliación de la vida laboral y personal) include:

    1. Promoting greater participation of women in the mining industry through continuous development of equal opportunities and non-discrimination in the processes of personnel management, selection, training, career development, and equal pay. 2. Abiding to best working practices and seeking a balance between professional and personal life, implementing employment policies and work systems that are better adapted to the nature of mining work and differences in location, without compromising work safety. 3. Promoting the awareness of Chile
    Standard 3262: Gender equality management system and conciliation of work, family, and personal life, as a guideline for addressing equality between men and women within organizations as a relevant issue in management 4. Promoting the inclusion of women in trade unions, and female leadership through the provision of tools that allow women to participate in equal conditions to men. 5. Promoting the
[^10]:    presence of women in decision-making positions, eliminating selection biases and preparing professionals to fill these positions. 6. Advancing towards an inclusive organizational culture geared towards diversity, raising awareness, and permanently training people at all levels of mining companies on gender issues. 7 . Creating adequate infrastructure for a mixed workforce in optimal conditions of safety, health, and comfort, considering the diverse needs of men and women. 8. Promoting the return to work of men and women after parental leave, in an environment of integration and with no adverse effect on their career and growth possibilities. 9. Strengthening joint work with higher education institutions and technical and professional training centres to encourage women to pursue programs related to mining, so that they know the industry and opt to work in the mining industry. 10. Contributing to sustainability and local development through work with women from communities in the area of influence of mining operations, promoting ventures and/or tasks related to mining, and making women's work and contribution visible.
    ${ }^{11}$ Among others, a. Adequate working conditions for men and women; b. Women's participation in the mining industry; c. Presence of women in decision-making positions.

[^11]:    ${ }^{12}$ Rojas, Carla (2016). Estudio Caracterización de la mujer en minería; barreras y desafíos [Study for the Characterization of Women in the Mining Industry: Barriers and Challenges].

