



Building bridges industry-university: Successful stories of professionals in mining towards increasing women participation

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Building Industry-University Bridges: Successful Stories of Increasing Professional Women's Participation in Mining

ABSTRACT

Chile is one of the leading mining countries globally, and one of its expectations is to increase the number of women participating in this industry. To that aim, it is essential to study the strengths of the academic programs to offer guidance to bridge the gender gap, eliminate gender stereotypes, increase the number of women who complete their undergraduate programs in mining or metallurgy, and incorporate women into the industry (promotion). This study analyzes professionals' perspectives in this area to propose actions to increase female students' interest and integration into the mining industry. We focus on knowing the story of successful professionals who have assimilated into the industry and gathering their recommendations to increase women's participation in mining programs and jobs. Our research is a cross-sectional diagnostic study of the labor integration of women in mining and metallurgy professions. We interviewed professionals in the industry and the university to obtain their perceptions of activities or initiatives that will increase the percentages of women in mining fields. The study consisted of semi-structured interviews with professionals to learn how they entered their professions and what can be done to increase the participation of women in the mining industry. The interviewees were primarily 1) mining industry professionals, 2) academic program managers, and 3) part-time academicians and industry workers. The study results yielded initiatives and actions to be implemented by the industry, academia, and joint efforts. The action plans will promote the integration of women into the workplace and the championing by experienced leaders in the industries to boost women's participation. The story of successful professionals and their perspectives on women's labor integration into the mining and metallurgic professions are the basis of industry-university activities to promote women's orientation toward labor issues and professional development.

Keywords: women's labor integration, mining industry, gender equality, women in engineering, educational innovation, higher education.

INTRODUCTION

The Chilean government has established laws and standards to promote gender equity in the workplaces, family households and personal life, which are critical to achieving gender equity. In 2012, the Equity Office created the Chilean standard called "Gender Equality and Reconciliation of Work, Family, and Personal Life" [1] to promote equal gender participation in all jobs. This standard guides industries and institutions in providing women's work participation and parental co-responsibility; it is certified as an ISO9000 Standard [2]. Moreover, it aligns with the Sustainable Developmental Goals regarding gender equity [3]. In 2016, the first mining site received the Chilean Standard 3262 certification. This milestone is officially registered with the Ministry of Women and Gender Equity [4].

Law 21.356 [5] establishes gender representation on the boards of directors of public companies, and Law 20.348 [6, 8] safeguards the right to equal remunerations between men and women. The Second Report on Gender Indicators of Companies in Chile [7] states that women held "20% of first-line management positions" (p.18) and about "10.6% of board positions in industries" (p.13). Moreover, the report indicated that women's salaries are lower by "10.2% and 10.9% at the administrative and executive levels," respectively [7]. Nuñez [9] argues that Law 20.348 "serves as a basis to make visible the existing differences, but today it is necessary to modernize the operational part," adding that there is a proposal to present "a bill on gender quotas in boards of directors for public companies and corporations." (p. 22).

In Chile, the Ministry of Women and Gender Equity [10] states that "as a country, we aspire to increase women's participation in higher education in technology areas up to 40% by 2030" (p. 67). The government is interested in increasing women's participation in all industry sectors, especially mining. For instance, in 2012, the free-of-charge program *Woman in Mining* (Mujer Minera, in Spanish) offered training to over 1,600 women on skills to facilitate their access to a job or activity related to mining, mining codes, and related policies [11]. Other initiatives include mentorships, apprenticeship programs, corporate talent programs, and early attraction and recruitment campaigns [12].

The mining industry is one of Chile's primary sources of income. However, women have been almost absent in the mining fields. As [13] stated, women's participation has been low and insignificant in salaried jobs. Unfortunately, this is not exclusive to Chile. [14] argued that the lower participation in the mining industry predominates internationally. In Chile, despite higher remuneration, improvements in the technological level, and a projected deficit of human capital in the sector, women's participation only represents 4.2% in operational areas [14].

The literature reports that the extraction and mining environments are predominantly male work areas [1, 4, 12, 13-15]. This situation limits women's professional development in that field, affecting their quality of life, sharing and growing within the mining community, and their family's financial stability [4,13, 15]. Moreover, the mining spatial metabolism produces mining territories where women face difficulties being part of them [15].

These difficulties include the following categories and descriptions:

1. Cultural issues
 - a. Cultural gender roles that promote men as source providers and women as responsible for household chores.
 - b. Stereotypes and biases in personnel selection methods, despite non-discrimination policies.
2. Job disadvantages
 - a. Job requirements that disadvantage women in defining years of experience.
 - b. Barriers between the mining industry and the companies that offer services of female personnel.
 - c. Hiring practices causing uneasiness for women, who must face more significant difficulties adapting to mining work's harsh and hostile conditions.
 - d. Lack of gender-oriented professional development programs, specifically for women
 - e. Low appreciation of women's skills relative to men's by recruitment offices.
3. Women in mining
 - a. The perception of a higher attrition rate for women than men.
 - b. Fewer women entering technical and professional careers related to the mining industry.

Women's participation and income level in the mining labor market is lower than men's. There are differences in average income between women and men, favoring the latter, who earn higher incomes, have similar or equal schooling and experience, and occupy the same positions [12].

In Chile, the gender gap is understood and assumed by political authorities and business leaders, as the development of policies and practices described above indicate [1-2, 7, 8, 10, 12, 16-17]. Therefore, women's representation is increasing over time. Specifically, in 2020, women's overall

participation in mining-related jobs increased up to 11.8% depending on the industry's size, 10.4% for suppliers and 12.3 % for mining companies [16].

Nowadays, women are rising to technical, professional, and high-level administrative positions depending on their academic or technical profiles. They perform various tasks ranging from truck driving, heavy machinery operation, and administrative support to company leadership. According to the INDICES Higher Education database of the National Education Council [18], the presence of women per mining specialty indicates that in 2020 the highest participation of women was in geology (32%), and the maximum first-year entry was 31% in mechanical and electrical maintenance [16]

Table 1. Presence of women per mining specialty [Source:16, p. 58, 20, 62, and 64].

Specialty	N° Programs in force (2020)	% Women Participation	% Enrolled First Year
Geology	111	32	24
Mineral extraction	132	29	25
Mineral processing	40	31	30
Mechanical and electrical maintenance	702	7	31

In higher education, programs have been activated to boost the inclusion of women in mining, reserving quotas for women and curricula that link engineering with other disciplines. Thus, women are making progress in this sector dominated by men. Despite all these efforts in Chile, the number of women enrolled in first-year engineering programs was 17% in 2016, and it has not increased significantly since then.

Therefore, it is vital to study the strengths of academic programs to offer guidance in bridging the gender gap, eliminating stereotypes, increasing the number of women who complete their studies in mining and metallurgy, and achieving their successful access and development in the industry. The study's objective is to analyze the criteria of action of professionals and, especially, of successful women in the mining field, regarding their experiences. This study aims to deepen understanding of professionals' perspectives in mining, both academic and industry. It will help us propose educational changes to attract, access, and offer guidance to young women interested in studying this field and envision ways to support early-career women to develop professionally in mining programs and jobs. Therefore, the research question guiding this study is: What initiatives or actions do mining professionals propose to increase participation and improve women's experiences in the workplace?

METHODOLOGY

The type of study is qualitative inductive, with an initial field immersion, data collection through semi-structured interviews, and interpretation of the content. The scope of the research is descriptive [19]. The research design is non-experimental and cross-sectional, locating and categorizing the data to provide the vision of the mining community in Chile. The sample selection was non-probabilistic.

The study made a reflective, in-depth analysis with a complete description of the situation. The participation requirement was to be a mining or supply company manager, a member of mining leadership associations, managers of universities, managers of mining research institutes, or

professionals with experience working in companies and the university in teaching related to mining. The interviewees were successful Chilean men and women in the mining field.

Participants

This study comprised 17 participating professionals in mining-related areas, nine women (52.94%) and eight men (47.06%). The researchers composing the sample focused on three main characteristics; gender balance, type of professional experience (academic, industry, or both), and years of experience (early career vs experienced). All invited professionals accepted to participate voluntarily in the study. Table 2 shows some of their leading professional characteristics. The participants' identities were confidential; their names in this paper are pseudonyms.

Table 2. Participants' attributive variables, professional profile, experience in university academy, professional mining experience, total years of work.

Name	Professional profile	Teaching experience (in years)	Professional experience (in years) and place	Total years of experience
Andres	Researcher and Doctor of Science	5	20, mining industry	25
Ben	Academic and industrialist, specialist in metallurgy and master's in Environment	7	16, company	16
Carlos	Academic and industrialist, specialist in mining	6	1, service company	7
Diego	Academic and consultant, master's degree in mining	5	10, mining consulting	15
Elena	Academic and industrialist, master's degree in mining	6	4, projects 7, industry (abroad)	11
Flor	Academic and industrialist, master's in Science, mention in Geology.	1,5	0.5, mining consultancy	1,5
Genaro	Academic and industrialist, master's degree in industrial engineering. Leader of a research institute	17	17, mining industry	17
Ignacio	Academic and manager in mining and politics, master's in finance.	9	28, mining management	30
Jose	Academic and mining management, Magister of laws (2 degrees)	10	23, mining management	23
Karla	Manager of mining association, mining specialist.	0	29, mining companies	29
Laura	Manager in a mining service area, company founder, metallurgy specialist	0	37, mining company	37
Manuel	Manager in mining production processes.	0	15, mining company	15
Natalia	Manager in mining health and safety, consultant, mining specialist in a national and international mining company.	0	15, mining company	15
Oriana	Manager of mining association, a specialist in mining and master's in innovation.	0	20, mining experience	20
Pina	Project manager, master's in Economics, a specialist in mining, foreign trade, national and international experience	0	16, mining industry	16

Rosa	Mining company executive, specialist in small and medium mining	0	15, in industry and mining company	15
Sara	Academic and industrialist, specialist in metallurgy and Doctor of Science	4, teaching; 6, research	2, industry	12

Table 2 shows that the participants had teaching and/or business experience in mining. According to the educational profile of the interviewees, all had a university education, and 70.59% had postgraduate degrees. Their professions were mining engineers, commercial engineers, metallurgical engineers, industrial engineers, geologists, geological engineers, chemical engineers, and lawyers.

Instrument

To obtain data, we conducted a semi-structured interview with successful people in the mining industry, validated by two academicians from the university. Each question was prepared considering their experience in the area where the research was oriented.

The interview protocol was designed considering the researcher's goals and the participants' confidentiality. Researchers created a friendly and professional atmosphere to generate an open dialogue during the interview. All participants signed a consent form and accepted the interview being recorded. At the end of the interview, the interviewee was thanked for participating [19-20]. Field notes were taken from the interviews, and the recordings were transcribed digitally into text. The interviews were coordinated through email and phone calls. We used videoconference platforms, such as Blackboard or Teams, to conduct the interviews, which lasted about 30 minutes each.

This study analyzed mining professionals' perspectives, focusing on the history of successful women who had joined the industry and their perspective of the workplace (mining industry) and the participation of women.

The interview questions were based on the sections about primary responsibilities in the General Directorate of Women's Labor Integration in Argentina [21]. The three categories considered for the interview were initiatives, integration, and equity (Figure 1). Among the topics presented were program implementation policies, recommendations for women's access to mining, gender equality, women's participation in development centers, and promotion of labor integration.

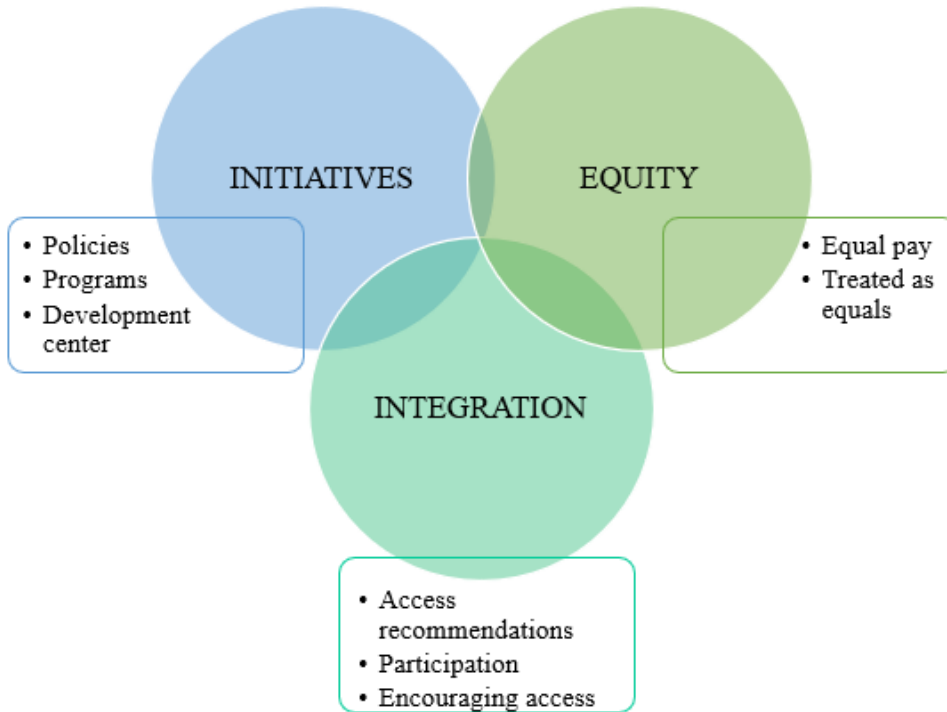


Figure 1. Categories and labor equity for women topics considered in constructing the interview protocol.

The semi-structured interview questions for all the topics indicated in Figure 1 are shown in Table 3. It includes all the topics for the three main categories (initiatives, integration, and equity):

Table 3. Topics and the semi-structured interview questions

Topic	Question
Policies (business and government)	What policies would you implement to achieve gender equity in employment opportunities?
Programs (initiatives)	What programs can be implemented to encourage women's labor participation?
Development centers	What is your opinion on creating development centers to encourage women in science, technology, and research to increase their integration into the labor force? Please give reasons for your answer. If you agree that a center for the development of women in science, technology and research should be implemented, what would you recommend as the main topics?
Access Recommendation	What recommendations would you suggest for increasing women's access to jobs?
Participation	What can be done to encourage greater participation of women entrepreneurs in Industry?
Encouraging access	What aspects do you think need to be analyzed to encourage the integration of women into the labor market?
Equal pay	How feasible do you think it is to pay for work without gender distinction? Please give reasons for your answer.
Discrimination	Have you experienced professional discrimination based on gender or heard of any cases?

Recommendations (academicians only)	What would be your recommendations to recent female graduates regarding labor market integration?
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Next, we present the results obtained from the interviews. Later, a discussion section offers the reader a richer insight into the results.

RESULTS

In response to the research question: What initiatives or actions do mining professionals propose to increase participation and improve women's experiences in the workplace? The authors interviewed and analyzed professionals' responses to building the industry-university bridge, putting them in three major categories (initiatives, integration, and equity).

Initiatives

The initiatives category includes policies, programs, and a development center. In terms of policies, participants mentioned some interesting strategies to bridge the gender gap, for example, maternity (and paternity) leave policies, training programs (in development centers), equality in staff contracts and selection, and STEM education training.

Academicians and industrialists spoke about equal contracts for men and women, considering the issue of maternity. Ignacio, an academician and manager in mining and politics with extensive experience in the industry, spoke about the importance of maintaining maternity leave policies to ensure that women remain in the workplace to continue their professional development while maintaining their personal or family development. Ignacio considered that companies should spend as much money hiring women as men. He further indicated that people having time for maternity leave adds to society, meaning it should not be viewed negatively.

Similarly, other participants mentioned programs that should be considered concerning motherhood. We observed differing opinions according to the participants' generational gaps and not gender. For example, Ben (16 years in industry and seven years in academia), Laura (37 years of experience), and Karla (29 years of work) mentioned the importance of equal involvement of men and women.

[Ben]: "...Try to level the degree of commitment or work those men and woman have ...there would have to be daycare programs, shared care programs, which are within the company's reach."

[Laura]: "...Childcare benefits, which have focused on mothers, have evolved for fathers and mothers. To prepare the students in taking care of seeing a solution."

[Karla] "...in the process of childcare, the State should intervene so that the responsibility of men and women is equal".

On the contrary, one of the younger participants (with less academic and industry experience) presented a vision of motherhood focused on women developing greater independence. In her words, "...the necessary support in childcare when going to work and being absent for a long time. Broaden the female vision lacking in the mining industry [Flor]."

In general, depending on the generation gap, participants argued about the importance of inclusive mechanisms (for women and men) that favor motherhood or initiatives and programs that allow the development of women, whatever their partner status.

The interviewees opined about creating development centers and the main issues to be addressed in these centers to integrate women into mining. The participants recognized that part of the problem is the lack of knowledge of opportunities and experience of women to compete in the labor market under equal conditions. So, some participants proposed training or guidance.

The academic professionals with work experience proposed promoting public and private collaboration to orient and train women from the beginning in the activities they would perform. Examples of these are Ignacio (28 years in industry and nine years in academia), José (23 years in industry and ten years in academia), and Elena (11 years in industry and four years in academia):

[Ignacio] "...working with the company to immerse the centers, so those trained know the environment and what they are going to do from the beginning to facilitate success so that resources are not allocated to people who later say that it was not what they thought."

[Jose] "...develop some training centers, research centers, to promote policies within large companies to encourage the hiring of women." "...Training seems to me to be quite essential to develop women's competencies in different areas. Eliminate any discrimination."

[Elena] "...women engineers in each village of a site can activate the company. They can give talks on mining work."

On the other hand, academically inclined participants commented on the importance of developing soft skills, research, innovation, and leadership, making companies and communities aware of activities that promote women's labor integration in mining, such as Genaro (17 years in both academia and industry), and Sara (10 years in academia and two years in industry). According to them, implementing policies with this initiative will help women participate in the labor market because they have been prepared with innovation, development, leadership, soft skills, and technical training [Genaro and Sara].

Moreover, participants also considered training a critical initiative to increase women's involvement in mining areas. Pina suggested that women take technical courses, such as truck and crane operations. Sara proposed training programs in highly technical mining and metallurgy areas. For them, training is the way to improve the female technical force, also assuming the mining company has an attractive wage equity policy. [Pina, Sara and Genaro]

The participants highlighted that training requires policies that promote adequate resources (economic, infrastructure and specialized personnel). The policies are the foundation for the programs that promote access to employment for women. As Ignacio mentioned, "...strengthening spaces to promote public and private collaboration, seeking funds, making efforts with resources, strengthening the instruments, providing specialized programs for women aimed to make it easier in the future for them to find jobs."

Professionals with work experience emphasized that companies' training is vital to recruiting personnel. Laura argued the importance of training the hiring officers to comply with the technical competencies and are sensitive to gender issues. Recruiters should offer a fair opportunity to every person with an objective evaluation and know how to evaluate the competencies that a person is expected to demonstrate in the company [Laura]. Moreover, Natalia indicated that the companies should have policies that help balance personal and work life.

Both the academicians and professionals with high work experience argued for training in STEM education for women in sciences in the early years of school education. These included Ignacio and the industrialists: Manuel (15 years of work experience) and Rosa (15 years of work experience).

[Ignacio] "...encourage from the most basic education that mining is an opportunity for women from the point of view of creating supply. From the demand side, there are a series of initiatives at a global level that seek transparency, including mining policies that should achieve parity."

[Rosa] "...to motivate women to study technical careers from the beginning, to have a balanced workforce....to start in schools giving mixed talks, promoting transversal insertion in the industry, and giving the story to men that efficiency, quality, and good environments are produced when there are mixed environments".

[Manuel] "... integration with the schools so that fourth-grade students participate in the company. The activities that could be done include learning about maintenance, operations, and camp management through internships."

Integration policies, Laws and Standards, and STEM education programs perfectly frame the opportunity to produce development centers that can be open places for women of all ages, in which knowledge and skills prepare and empower participants.

Integration

Recommendations to increase the integration of women in jobs included participants' opinions about the regulation of distance to work and work modalities, which help women without diminishing their participation in family life. Ignacio, Genaro, and Laura suggested that working can be adapted to balance professional and personal responsibilities. Policies can regulate access for women. Ignacio proposed fully applying the regulations to have a mining camp with regional development policies that facilitate access. Moreover, Laura considers that distance work (online) should be implemented for specific roles or times, which would benefit women and their families.

Sara and Jose, academicians with work experience mostly in industry, and Laura recommended reviewing and revising the industry requirements if necessary so more women could be on boards of directors and motivating people to move from places where mining is not the main industrial sector. Karla mentioned having a multidisciplinary team of men and women at all levels of the organization to enrich perspectives and decision-making processes. In her words, a working table of women and in mining, influencing public and private policy, forming the company's strategies to modify the way of operating." In the same line, Jose suggested that the boards of directors of large companies should develop policies that promote the integration of women in this sector, i.e., to link promotion with program and policy initiatives.

To encourage greater participation of women entrepreneurs in the industry, the interviewees expressed their opinions about promotion instruments, funds for applications from women entrepreneurs, and compliance with bidding processes.

Some participants spoke about special employment quotas for women and parity between women and men. Specifically, Jose, Oriana, and Karla's opinions on this topic are as follows:

[Jose] "...there must be parity in salaries." "*Parity should be established by the boards of directors of public companies and, subsequently, private companies should move in that direction.*"

"There must be regulation that ensures equal pay for men and women." "Define some areas where it is crucial to have parity." "Implement specific quotas in jobs that historically have been more related to men than women."

[Oriana] *"...gender quota: it is necessary to implement accounting measures for increased gender participation and diversity of teams, gender, race, and university backgrounds, with realistic, quantifiable measurement of progress over time."*

[Karla] *"...incentives that reward hiring women, cover gender costs, allow greater access, provide qualification and training of what it means to work in mining, form multidisciplinary teams with well-qualified professionals, develop gender policies, involve the medium and small mining segment and suppliers."*

Jose, Oriana, and Karla are the only participants who emphasized the need to establish specific quotas for women to enter the industry to encourage integration. It is relevant because those who propose it have a high level of experience in the industry or academia. Recall that the question was about policies and programs, and the participants elaborated on what they considered most relevant. Other participants proposed other initiatives, as elaborated below:

The academic professionals with work experience recommended learning the promotion instruments that best disseminate information about job openings, training, entrepreneurship, and innovation skills that prepare for applying for private and state funds.

Some recommendations for female early-career students and recent graduates regarding job placement include training, skills specialization, open-mindedness, eagerness to take advantage of opportunities, resilience, and communities in the mining industry should embrace women.

In the case of professionals with work experience, it was proposed to garner women's participation by promoting a subsidy for women entrepreneurs. This would attract women to entrepreneurship and the possibility of growing and developing in a dignified and sustainable manner. These professional women should be supported with planning, resources, and the training to start a business.

[Pina] *"... government level support - some incentive fund to install women in this type of company, encourage at the government policy level, so women want to investigate this area, as suppliers to the industry, new government plans at contractor level. We can call for a competition for women entrepreneurs to provide services in mining products, have policies that incentivize SMEs (small and medium enterprises) to form."*

[Manuel] *"...comply with tenders, have the ability to support the service. The circular economy makes participating in mining possible. Generate finished products."*

[Oriana] *"...Open a call for women entrepreneurs and trying to move the industry toward this form of diversity, where they can incorporate this group of women entrepreneurs."*

[Natalia] *"If you have an idea and it is planned and orderly, it allows time management and the ability to start that business."*

In this category of integration, the participants highlighted recommendations to increase participation in sustainable entrepreneurship. The recommendations included establishing norms, considering the work environment, and urging flexibility of the work modality (face-to-face or remote; work shifts). To increase entrepreneurial development, the participants pointed to the need for policies and the

commitment of companies to invite women to develop their entrepreneurship. Finally, regarding access and guidance to maintain and grow an enterprise, they mentioned that women must have the support and accompaniment to succeed.

Equity

The most experienced participants spoke about the need for equal pay and benefits regardless of gender. This is the case of participants with experience in both industry and academia: Ignacio (28 years in industry and nine years in academia), José (23 years in industry and ten years in academia), or those who only have experience in industry, like Karla (29 years of work), and Oriana (20 years of work). The following are their opinions.

[Ignacio] *"It should be regulated: equal work, equal pay; the regulations would apply to contractors, workers, men, and women."*

[Jose] *"...I see it more and more possible. It will not happen overnight: Same job, same salary. There must be policies that aim to reduce the salary gap between men and women."*

[Karla] *"...They change with the generations that have internalized the issue of women. Women are more empowered than before; there are professional evolution and entrepreneurship leading to pay equity."*

[Oriana] *"...for supplier companies and client companies, the established diversity policies or government policies must state that there can be no pay differences of any kind by gender."*

Gender diversity achieved by developing job roles in the mining industry, suppliers and customers must be supported by programs that decrease the wage gap.

Equal pay is the central theme in the equity category. It is mentioned by all participants with experience, both in academia and industry, women and men. We are struck by the fact that participants with fewer years of work experience (in academia or industry) did not bring this issue to the discussion. It will be necessary to investigate further why they did not mention it; it may be precisely because of their short experience that their vision is limited.

Regarding women's inequality, academicians and industrialists mentioned that the mining industry has evolved, decreasing discrimination, but there is still a long way to go. Natalia was questioned about her interest in mining because she has children. The case of Sara caught our attention because she thinks she was discriminated against for being a woman, but her pain sounded current as she reflected on the past. Gender discrimination is so common that sometimes it is not even recognized. However, thanks to the Chilean laws and standards and increasing societal awareness, some improvements in equitable practices are occurring in all sectors. As Oriana mentioned, "...working on barriers of stereotypes and prejudices in this masculinized environment has led to decreased labor harassment in the last three years. In the smaller areas, there is much discrimination. We must rely on more experienced professionals to eliminate these things in the company."

The participants proposed in the *professional* area to manage administrative, economic, and financial resources, generate networks of public and private organizers and universities to create development centers, guide women entrepreneurs in business management, equalize the female labor force to contribute economically under equal conditions and opportunities, and make known the functions of each position so that women can have a clear idea of where to develop the level of studies and skills required to perform an activity. In the *operational* area, they also propose that the

needs and skills required for each position should be precise and that labor should be generated for operational and maintenance tasks.

DISCUSSION

The study results turned up several action initiatives from the participants to integrate women's labor into mining. These perspectives coincide with those raised in the research conducted [4].

Regarding the policies, participants' ideas completely align with incorporating gender costs in policies and strategies of the mining business, increasing the number of women hired, and allowing women access and job training in mining [1-2, 5]. It is an achievement that such laws exist, but they need to be implemented [22-24].

For companies to have cost equity when hiring women and men, some of the participants mentioned they need to add maternity leave without any penalties for women, mentioned the participants. Companies should not perceive maternity leave as a barrier but rather as a way to provide wellness to their employees and families. A new set of cultural beliefs is needed to appreciate maternity leave as a positive benefit for all; the happier the employees, the better the work environment (and productivity). Implementation of public policies fosters the balance between the personal and professional life of the employees. Along the same line, childcare support and maternity leave for new fathers should be considered to fully support women in the mining industry. It is essential to focus or intervene in the recruitment processes for equal opportunities to develop. Mining companies must comply with the Chilean laws [1-2, 5, 22-24].

The proposed programs are related to education and training, with campaigns to increase the entry of women into mining-related careers, based on activities dedicated to the study of Science, Technology, Engineering and Mathematics (STEM) disciplines to encourage their participation in mining from an early age. It is proposed to offer internships to students in their last year of secondary education to learn about the mining and extraction industry activities. Also, these programs should include talks or seminars on women's socio-cultural role in the family and society (stereotypes and biases).

In the access recommendations, interviewers proposed continuous conversations with the Ministry of Mining and creating support groups for women in mining to address issues of public and private policies. Having this channel of communication and community groups may help improve strategies to increase women's participation in the mining companies and attend efficiently and promptly to any situation related to women's participation. Other recommendations include professional development courses in diverse topics, such as training programs, leadership programs, and specialized mining courses. Also, women should have seminars to keep them informed and up to date on leading mining companies, job openings, submitting a successful job application, and preparing for a job interview. Mining companies should broaden their scope in the regions where they conduct their attraction campaigns. They should encourage the participation of people from the central and southern parts of the country to learn about mining and become interested in being part of this industry.

Concerning participation, the interviewers highlighted the involvement of the governmental entities in the promotion of the country's mining production and proposed encouraging and rewarding companies led by women. There must be a commitment from supplier companies to apply standards that guarantee participation, inclusion, and sustainable development. Private and state funds are needed to promote the work of entrepreneurs. Women must be trained and offered the opportunity to specialize and research in the areas they are going to innovate, comply with the bids, and have

the capacity to support the service. The choice of these entrepreneurship projects should be made through government-level competitions. A woman's entrepreneurship is an opportunity to employ other women in the same working and family conditions, to break cultural barriers according to the cultural roles of women.

Development centers encourage women to specialize in mining, and their activities must favor equalizing women's labor forces in society. In those sites, women can develop skills and prepare for different levels of education. They can manage resources, organize networks with universities and research centers that develop business competencies, form relationships with associations and foundations, and seek women mentors for business development and management guidance. Women need to contribute to society with equal conditions and opportunities.

The training topics offered in development centers should be based on knowledge of the mining environment and the specific activities carried out in that sector, e.g., technological autonomy, information systems, environmental sustainability, business leadership, soft skills, and technical training in circular mining, sustainable mining, and extraction planning. Lectures on mining for communities surrounding mining operations are essential in integrating women into mining. The centers should assist mining companies in research. They should also support the creation of pilot plants for mining processes and apply for research grants in which the associated costs are guaranteed to be covered.

To integrate women into the labor market, companies must balance costs between men and women, including maternity leave as something shared without negatively impacting remuneration. This points to implementing gender quotas in companies and quantifiable measures of women's participation and inclusion in the work teams. There are many activities in the mining company, from operational to managerial. Therefore, in the mining industry, it is vital to have a trained workforce supported by incentives and equity laws and to have the will to comply with the tasks entrusted. Networks of people of different ages and experiences supported by foundations can help women feel empowered and learn activities for work development.

Our study aims to provide these recommendations to students, academicians, and industry partners so that initiatives can be taken to increase the labor market integration of women. The university is no different from the industries concerning gender reality, so these professionals in mining specialties should be well prepared. Knowing the experiences of successful women in this environment would help students and recent graduates to overcome the barriers of bias, stereotypes, and beliefs as they adapt to the work environment.

CONCLUSIONS

This study aims to propose actions to promote the labor integration of women in the mining industry and help them achieve balanced development between their professional and personal lives. In this study, the authors inquired about policies to implement, action programs, equal pay, promotion of participation, creation of development centers, and gender discrimination.

The proposed initiatives for implementing the actions align with the idea of fostering women's participation in STEM disciplines from an early age. Women's advancement in professional studies in mining must be supported by the family, the community, the university, and the mining industry. They should have mentors and support from the development centers to foster multidisciplinary and collaborative work. It is proposed to have support groups for women, led by female academicians and industrialists. The alliances between universities and industries, professors and researchers, students and people from the industry must all have the same goal, to conduct activities that boost

the participation of women in mining. There is still a long way to go. However, alliances between all the people and organizations involved will modify the culture and practices to accept a world of equal opportunities for all.

Acknowledgements

We thank those who participated in this study for their perspectives and action proposals to encourage the integration of women in the mining industry.

The authors acknowledge the financial and technical support of the Writing Lab, Institute for the Future of Education, Tecnológico de Monterrey, Mexico, in the production of this report.

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