Green Dealings

A just and sustainable lithium battery value chain

Delphi Survey - Results Report

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The project has been funded by the Swiss Network for International Studies, under the agreement N° C21055.

About Green Dealings

The Green Dealings research project aims to examine the rules and dynamics being negotiated and established between Europe and South America concerning the lithium-ion battery value chain. Its primary objective is to facilitate the transition towards a more sustainable and just value chain, particularly from the perspective of lithium-rich countries in South America. The project has received funding from the Swiss Network for International Studies (SNIS) under project code C21055.

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Institutional Partners

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About this report

This report has been translated into English by the authors from its original version in Spanish. This report presents the results of the Delphi survey "A just and sustainable lithium battery value chain" conducted in 2022. In June 2023, an executive report was published in which a synthesis of the aggregated results was presented.

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Foreword

As demand for lithium increases, fueled by the expansion of electromobility, new economic opportunities open up for producing countries. However, this growth also carries risks of negative impacts on the environment and the communities residing in lithium extraction areas. In addition, there is the possibility of wasting opportunities for developing productive, and technological capacities.

Better understanding these dynamics and establishing appropriate governance schemes in the lithium-ion battery value chain are key objectives of the Green Dealings research project, entitled "Green Deals: negotiations around lithium-ion batteries between North America and South and Europe for a just energy transition". To achieve these objectives, it is essential to understand the perspectives of the various actors involved to move towards a more sustainable and equitable value chain, especially from the perspective of countries rich in lithium in brine.

It is with great satisfaction that we present the Delphi study, carried out under the responsibility of Martin Obaya, a researcher at the Universidad San Martín in Argentina. This study benefited from the participation of experts from various fields, who have contributed their knowledge and experience to explore and analyze the multifaceted challenges and opportunities around lithium mining and its impact on environmental, social, and economic sustainability.

The results obtained in this study provide a broad and agreed view on the need to address the sustainability challenges associated with the extraction of lithium in brines, even if it implies the slowdown or suspension of mining activity. We hope that the findings will contribute significantly to the debate and decision-making in the field of policies and strategies related to lithium-ion batteries in search of a just and sustainable energy transition.

With this study, we aspire to lay the foundations for a more responsible and equitable approach in the lithium value chain, which guarantees the well-being of communities, environmental protection, and sustainable development in producing regions.

Marc Hufty

Green Dealings Coordinator,
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Introduction

Climate change is undoubtedly one of the greatest challenges of our time. The energy transition is the main globally agreed-upon mechanism to curtail greenhouse gas emissions and address this problem. Lithium-ion batteries are a key technology in this process, with their role in the decarbonization of transportation, responsible for approximately a quarter of worldwide carbon dioxide emissions, taking center stage. The rapid growth of electromobility significantly propels the demand for some minerals essential in the production of batteries, a critical device for storing energy in electric vehicles. According to estimates from the International Energy Agency, lithium will experience the most pronounced growth in demand in the coming decades, surpassing even graphite and cobalt.

Argentina, Bolivia and Chile form the so-called "lithium triangle", a region that concentrates 53% of the world's lithium resources and around 80% of those found in salt brines[1]. The growing demand for lithium, driven primarily by the expansion of electromobility, presents new economic opportunities for these countries. However, this process also entails potential adverse environmental and societal consequences in the regions where lithium mining takes place. Another challenge lies in seizing opportunities to develop productive and technological capabilities. Governments of resource-rich countries, in charge of regulating and monitoring mining activities, share the primary responsibility with the operating companies in ensuring compliance with sustainability requirements. Additionally, they play a pivotal role in crafting policies and strategies to leverage lithium as a platform for national and regional socioeconomic, scientific, technological, and productive progress.

These concerns have gained attention in public discourse, drawing interest from different stakeholders such as companies linked to the industry, local communities living near salt flats, non-governmental organizations and academic researchers. Over the years, these groups have identified actual or potential imbalances resulting from lithium mining and have put forth recommendations to address these issues. More recently, the European Union has also decided to advance in this field. This economic and political region, which a few years ago embarked on developing a lithium-ion battery industry, has set out to establish a lithium-ion battery industry, aims to guarantee a steady and continuous supply of lithium compounds produced under sustainable conditions.

Within this context the Green Dealings network developed its research project "Green Dealings: negotiating lithium between South America and Europe for batteries that fuel a just energy transition". Initiated in 2022 the project aims to examine the governance schemes currently under negotiation and formation between Europe and South America concerning the value chain of lithium-ion batteries. Our goal is to gain insight into the perspectives from different stakeholders regarding the path to a more sustainable and just value chain, particularly from the perspective of brine-based lithium-rich countries. The project, funded by the Swiss Network for International Studies, concluded in October 2023 with a closing conference in Geneva, Switzerland.

This report presents the results of the Delphi survey "A just and sustainable lithium battery value chain". It encompasses findings from the two consultation rounds, offering insights segmented by the respondent's country of residence (lithium-demanding and lithium-rich countries) and respondent categories (industry, government, non-governmental organizations and academia).

The survey´s results are rich and complex. We are confident that it will provide a valuable data source for researchers, government and international agency officials and, more broadly, for civil society. This document serves as a guide to read the principal findings presented in the charts included in the main body of the report and in the annexes. The report includes boxes with comments and opinions from

1 Source: USGS (2023). Mineral commodity summaries 2023, U.S. Geological Survey.

three virtual workshops involving survey stakeholders. These workshops served as platforms for presenting and deliberating on the initial survey results (for additional details on the workshops, please refer to the Annex 1 - Methodological Design). They played a crucial role in enhancing and contextualizing some of the study's results.

Delphi Survey "A just and sustainable lithium battery value chain" - Presentation and methodological summary

During the second half of 2022, we conducted a virtual Delphi survey[2] entitled "A just and sustainable lithium battery value chain". The survey's primary focus was to gather expert insights into the main challenges related to the sustainability of lithium mining in salt flats. Furthermore, the study aimed to gauge participants' views on initiatives and public policies to tackle the identified sustainability and justice issues. Given the highly dynamic regional landscape, where each country has addressed sustainability challenges by using different perspectives and tools, the survey results provide valuable information on the priorities identified by the experts and potential approaches to address them.

The survey consisted of two rounds conducted between August and December 2022, with invitations extended to over 600 experts in the global lithium battery supply chain worldwide. Participation was anonymous and confidential, with respondents participating in its personal capacity, omitting any consultation of their organizational affiliations. In the first round, 141 experts participated, followed by 83 participants in the second round. Across both rounds, the panel predominantly consisted of experts from Argentina, Bolivia, and Chile, with academia being the most prevalent category, followed by industry, government, international organizations, and non-governmental organizations (for additional information, please refer to the Panel Composition section). Unfortunately, the survey did not include members of indigenous communities, primarily due to connectivity challenges faced by these communities. This obstacle, stemming from the virtual and anonymous nature of the survey, undoubtedly presents a limitation in interpreting the results, considering that these communities are among the primary stakeholders impacted by the sustainability issues associated with lithium mining.

The questionnaires for both rounds comprised two main sections: a comprehensive sustainability section, divided into four subsections (covering general sustainability, and environmental, economic, and social sustainability), and a concise section focusing on justice. In the first round of the survey, a questionnaire with 16 questions was distributed (8 open-ended and 8 closed-ended). The open-ended questions were designed to comprehensively cover all relevant issues and the 8 closed-ended multiple-choice questions sought to prioritize challenges and corresponding initiatives. For the second round, the questionnaire incorporated the outcomes from the first round, featuring 13 closed-ended questions. Additionally, we introduced 6 statements, prompting participants to express their level of agreement or disagreement. This approach allowed us to assess whether significant shifts occurred in the panel's responses, reaffirm existing consensus, identify disagreements and priorities.

The main body of this document presents the results from the second round unless otherwise specified as related to the first round. It's important to note that no significant variations were observed between the two rounds in terms of the results. The results are initially presented in aggregate, considering responses from the entire panel. Subsequently, in each case, the data is broken down into two distinct categories: based on the respondent's country of residence and the stakeholder group they belong to. Country of residence classification was determined in the first round, categorizing panelists into two groups: lithium-demanding countries (including the United States, Canada, and European

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2 The Delphi method is an information gathering technique used to obtain the opinion of experts or people with extensive experience in a subject on which the available information is scarce. This type of survey is anonymous and has an iterative dynamic, developing in rounds,in which the results of the previous round are circulated among the participants. The objective is to identify dissent and achieve some consensus on key issues.

nations) and countries rich in brine-based lithium resources (Argentina, Bolivia, and Chile[3]). In the first round, respondents were also asked to specify their main stakeholder group, which led to the grouping of respondents into six categories: industry, government, international organization, non-governmental organization (NGO), academia, and indigenous communities. Since the categories international organization and indigenous communities did not meet the minimum participation threshold, only the disaggregated results of the remaining four categories are presented[4].

The report includes three annexes: i) A methodological annex provides comprehensive insights into methodological aspects, outlining the composition and responsibilities of the implementation team, panel recruitment procedures, survey design and execution, data processing, and a detailed description of the virtual workshops conducted in June 2023; ii) A second annex comprises the outcomes from Round 1; and iii) A third and final annex contains the complete questionnaires completed by the panel for each round.

Panel composition

In the first round of the survey, 141 people participated, with the second round seeing 83 participants, indicating a retention rate of 58%. In both rounds the panel was predominantly composed of participants from countries rich in brine-based lithium resources, who accounted for 61.5% of respondents in the second round (Figure 1) (68% in the first round), especially participants based in Argentina (37.3% in the first round and 39% in the second round). Bolivia accounts for 14.4% (15.6% in the first round), and Chile for 9.6% (13.5% in the first round). In the second round, 33.7% of the panel came from lithium-demanding countries, mainly from Europe and North America[5]. The "Other" category (4.8%) corresponds to participants from Latin American countries without lithium resources in salt flats and from Australia[6].

Regarding the sector of activity, despite efforts to establish a panel with a balanced representation of various stakeholder groups (see section Recruitment and composition of the expert panel in the Annex), the majority of the panel consisted of researchers from the scientific and university system, comprising nearly 46% of the total panel in the second round (Figure 2) (36.8% in the first round). They are followed by government and international organizations at 20.4% (21.9% in the first round), industry at 18.1% (24.8% in the first round) and NGOs at 14.5% (14.9% in the first round).

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3 The category "lithium-demanding countries" includes countries that also have lithium resources. The classification is based on the dominant position they currently have (or plan to have) in the battery value chain.

4 The inclusion criterion was that the observations in the category were greater than 10 (N > 10). The inclusion criterion was that observations in the category should represent at least 12% of the total number of observations. Responses from categories that did not meet the threshold were not considered in the disaggregated analysis.

5 The category of "lithium demanding" countries indicates the dominant position that these countries (or the region to which they belong) currently hold in the battery value chain. 27.7% of the survey participants came from Europe, with 4.8% from Switzerland, 3.6% each from Germany, Belgium, Portugal and the UK, 2.4% from Spain, and 1.2% each from Austria, France, Norway, the Netherlands and San Marino. Six percent of the participants came from North America, with 3.6% from Canada and 2.4% from the United States.

6 Mexico accounted for 2.4% and Peru and Australia 1.2% each.

Figure 1

Panelists' position in the value chain (Round 2)

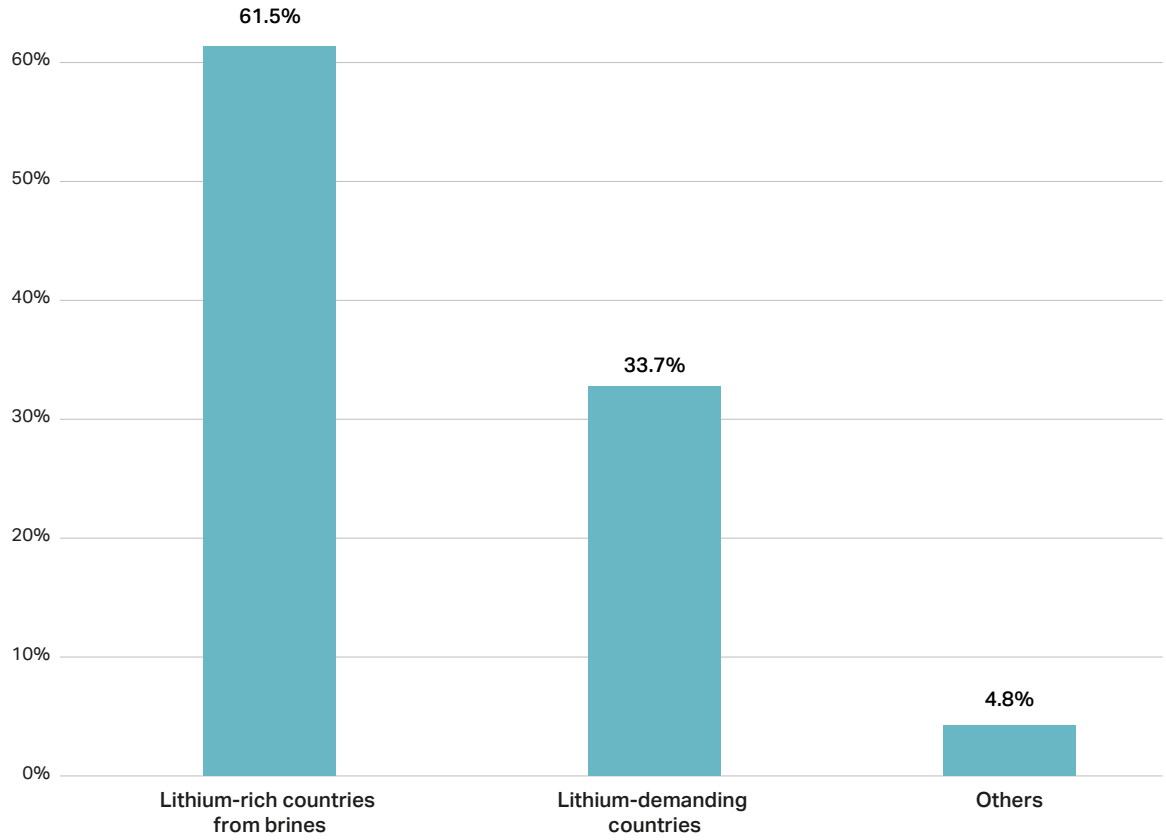
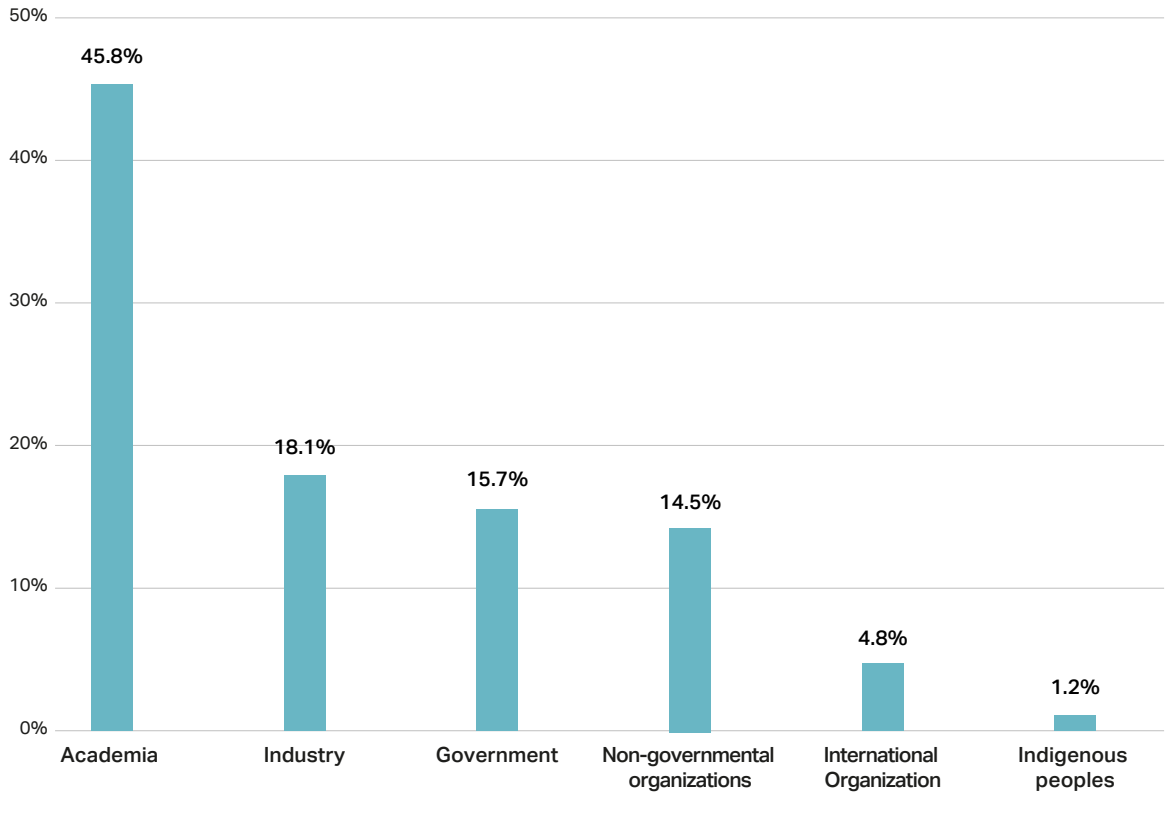


Figure 2

Panel membership group (Round 2)



Summary of results

Summary of results

The survey results exhibit significant diversity and depth of insights. This summary section provides a curated selection, highlighting the top two or three challenges and public policy instruments most prioritized by the panel. It also offers an overview of findings categorized by country of residence and group affiliation. It is worth noting that this report only includes data from the four main groups (academia, industry, government, and NGOs). Responses from participants associated with international organizations and indigenous communities were not included in result breakdown, as they did not meet the minimum threshold of 12% representation in the panel.

Challenges to sustainability and courses of action for lithium mining

The survey conveys two clear messages about the sustainability of lithium mining in salt flats. Firstly, a significant majority of the panel (67%) perceives lithium mining in salt flats as presenting significant sustainability problems. Participants from lithium-demanding countries regard these problems as more severe when compared to participants from countries rich in lithium brine. Upon examining responses by membership group, it was the participants from NGOs who expressed the highest concern, with 66% rating them as "very significant" issues, followed by respondents from academia and the government group (37% and 31% of participants, respectively, rated them as "very significant"). This viewpoint contrasts with that of industry respondents, since only 13% perceive these problems as very significant, while 46% characterize them as specific. When queried about the most pressing sustainability issues, the panel collectively identified environmental concerns as the foremost challenge, followed by social, economic, and lastly, institutional issues related to mining sustainability governance.

The second message of the survey is that the expansion of lithium mining projects cannot continue without addressing sustainability issues, a consensus shared by the entire panel. A significant majority of respondents (77%) consider that measures should be taken, even if this entails either slowing down the pace of expansion (56.6%) or suspending the activity completely (20.5%) (Figure 4.1). When analyzing the stance of different groups, it is evident that all groups prioritize addressing sustainability issues, even if it leads to a slowdown in the expansion of lithium mining. However, their secondary preferences vary: participants from industry and government tend to prioritize solving sustainability problems without impeding mining expansion, whereas those from NGOs and academia prioritize sustainability, even if it requires suspending the activity (Figure 4.3).

Environmental sustainability

Among environmental sustainability challenges, the panel identifies the impact on the water balance, availability and quality of water in the basins of the salt flats as the most significant concern, followed by the impact on biodiversity and ecosystem services. An examination of the prioritized challenges based on country of residence and group affiliation reveals that, in all categories, these challenges occupy the highest level of prioritization (Table 1.1). The sole exception is among NGO representatives, who place the decrease in lithium demand as a secondary priority (as shown in Figure 8.3).

In this context, responses to the question of what tools should be prioritized to address these challenges focus on measures to enhance government investment (as indicated in Table 1). Participants suggest actions should center on improving the generation and transparency of environmental information, increasing the government capacity to monitor compliance with environmental standards, and investing in the development of new extractive technologies that reduce mining impacts on the water balance and biodiversity. In addition to measures related to state investment, promoting multi-stakeholder collaboration to address the identified environmental challenges emerges as a secondary priority (Table 1).

Environmental sustainability of lithium mining in salt flats. Summary of the challenges and tools most prioritized by the panel of respondents

Table 1

Priority challenges	Prioritized public policy instruments
1° Avoid or mitigate the negative impact of lithium mining on the water balance of the basin where the salt flats are located.	1° Increase state investment to create baselines, improve the generation and transparency of public environmental information, especially on water balance and biodiversity issues in each salt flat.
2° Avoid or mitigate the negative impact of lithium mining on the biodiversity of the ecosystems where the activity is carried out.	2° Promote multi-stakeholder cooperation (alliances between companies, government and research institutions, etc.) in mining countries to address the challenges of water balance and biodiversity in each salt flat.
3° Improve the management of lithium mining liabilities that pose a risk to the environment and human health (e.g., waste).	3° Increase state investment to strengthen government monitoring capacity and ensure compliance with environmental standards.

Source: Delphi survey results.

Examining the diversity of the responses reveals that participants from countries abundant in lithium resources notably emphasize topics related to information generation and the promotion of technologies aimed at enhancing sustainability conditions. Conversely, participants from lithium-demanding countries prioritize investment to strengthen governmental regulatory capabilities. Analyzing responses by stakeholder group reveals notable differences. Participants from the government group share a common priority with academia: an emphasis on the generation and transparency of environmental information and, similar to industry representatives, exhibit an interest in enhancing extraction technologies (Table 1.2). In contrast, participants from NGOs prioritize regulatory reforms to establish more rigorous standards and participatory mechanisms as tools for addressing environmental sustainability challenges.

Environmental sustainability of lithium mining in salt flats. Challenges prioritized according to country of residence and group

Table 1.1

Environmental sustainability	Country of residence		Group			
	Rich in lithium brine resources	Lithium-demanding	Government	Industry	NGO	Academia
Challenges (ranking out of 7 possible)						
Avoid or mitigate the negative impact of lithium mining on the water balance of the basin where the salt flats are located.	1°	1°	1°	1°	1°	1°
Avoid or mitigate the negative impact of lithium mining on the biodiversity of the ecosystems where the activity is carried out.	2°	2°	2°	2°	3°	2°
Improve the management of lithium mining liabilities that pose a risk to the environment and human health (e.g., waste).	3°	4°	3°	3°	4°	3°

Source: Delphi Survey (Figures 8.2 and 8.3).

Summary of results

The promotion of multi-stakeholder cooperation to address the identified challenges is a highly prioritized tool, by both lithium-demanding and lithium-rich countries. Conversely, when examining responses across different membership groups, there is a wider dispersion in the responses. Participants from the government and industry groups strongly prioritized this type of collaborative mechanism, whereas those from NGOs attributed it a significantly lower level of importance (Table 1.2).

Environmental sustainability of lithium mining in salt flats. Tools prioritized according to country of residence and group

Table 1.2

Environmental sustainability	Country of residence		Group			
	Rich in lithium brine resources	Lithium-demanding	Government	Industry	NGO	Academia
Public policy instruments (ranking out of 7 possible)						
Promote multi-stakeholder cooperation (alliances between companies, government and research institutions, etc.) in mining countries to address the challenges of water balance and biodiversity in each salt flat.	2°	1°	1°	1°	5°	2°
Increase state investment to create baselines, improve the generation and transparency of public environmental information, especially on water balance and biodiversity issues in each salt flat.	1°	2°	2°	4°	3°	1°
Increase state investment to create baselines, improve the generation and transparency of public environmental information, especially on water balance and biodiversity issues in each salt flat.	3°	6°	3°	3°	6°	4°
Increase state investment to strengthen government monitoring capacity and ensure compliance with environmental standards.	4°	2°	4°	2°	4°	3°
Regulatory changes in mining countries requiring compliance with rigorous environmental standards, external audits and certifications.	6°	4°	6°	6°	1°	7°
Changes in regulations to ensure greater community participation in environmental monitoring and decision-making.	5°	5°	7°	5°	2°	5°
Regulatory changes in lithium-importing countries requiring compliance with rigorous environmental standards, external audits and certifications.	7°	3°	5°	7°	3°	6°

Source: Delphi survey (Figures 9.2 and 9.3). Note: challenges that share the same position in the ranking obtained the same value in the ranking index that was built to process the responses.

Summary of results

When asked about the key actors responsible for leading the prioritized initiatives, participants assign high importance to the governments of lithium-producing countries, particularly at the national level. Subsequently, local communities and stakeholders from the academic sector were also recognized as pivotal actors in this regard.

Social Sustainability

Regarding social sustainability, the panel highlights two priority challenges. The first entails formulating a strategy that facilitates the coexistence of lithium mining with other regional economic activities, such as tourism or agriculture. The second challenge, closely interconnected with the former, revolves around mitigating the adverse impacts of the mining activity on the social and cultural practices of local communities, which includes respecting their rights and guaranteeing the effective implementation of free, prior and informed consultation with indigenous peoples (Table 2).

Social sustainability of lithium mining in salt flats. Summary of the challenges and tools most prioritized by the panel of respondents

Table 2

Priority challenges	Prioritized public policy instruments
1° Develop a strategy that allows for the coexistence of lithium mining with other regional economic activities (e.g., tourism or agriculture).	1° Conduct strategic and land use planning that favors the coexistence of lithium mining with other regional economic activities (e.g., tourism or agriculture).
2° Mitigate the negative impacts of mining activity on the social and cultural practices of local communities.	2° Develop consultation mechanisms that incorporate the perspectives of the different stakeholders and are sensitive to cultural diversity (e.g., for prior consultation with indigenous peoples).
3° Implement good practices of engagement and build shared views between civil society and lithium mining companies.	3° Changes in legislation to ensure that companies incorporate the demands of civil society in the process of defining the terms under which lithium mining is carried out.

Source: Delphi survey results.

Examining responses based on stakeholder group reveals a unanimous priority: the development of strategic planning and land use planning that supports coexistence with other regional economic activities. Notably, industry and academia participants consider this as the most significant challenge (Table 2.1).

Regarding the impact on social and cultural practices, a notable disparity emerges in the responses: participants from NGOs rated it as the primary social sustainability challenge. In contrast, for participants from industry, government and, to a lesser extent, academia, it holds a lower priority (Table 2.1). Likewise, representatives from NGOs and academia prioritized incorporating the demands of civil society in the processes of defining the terms under which lithium mining is carried out. This contrasts with government and industry participants, who regard it as a less significant challenge.

Social sustainability of lithium mining in salt flats. Most prioritized challenges according to country of residence and group of belonging

Table 2.1

Social sustainability	Country of residence		Group			
	Rich in lithium resources in brine	Lithium-demanding	Government	Industry	NGO	Academia
Challenges (ranking out of 9 possible)						
Develop a strategy that allows for the coexistence of lithium mining with other regional economic activities (e.g., tourism or agriculture).	1°	1°	2°	1°	2°	1°
Implement good practices of engagement and build shared views between civil society and lithium mining companies.	2°	4°	1°	2°	8°	2°
Improve communication and information on mining activities between companies, governments and local communities.	3°	6°	3°	3°	5°	4°
Mitigate the negative impacts of mining activity on the social and cultural practices of local communities.	4°	2°	5°	4°	1°	3°
Raise regulatory requirements and labor standards for mining companies and their suppliers.	9°	3°	9°	5°	4°	5°
Incorporate the demands of civil society in the definition of the terms under which lithium mining is carried out.	7°	5°	7°	8°	3°	4°

Source: Delphi survey (Figures 11.2 and 11.3). Note: challenges that share the same position in the ranking obtained the same value in the ranking index that was built to process the responses.

In general terms, the public policy initiatives selected by the panel are consistent with the prioritized challenges. The foremost choice revolves around the development of strategic planning and land-use planning that favors the coexistence of lithium mining with other economic activities. The second most favored initiative is the development of consultation mechanisms sensitive to cultural diversity, followed by the introduction of legislative changes to compel companies to integrate civil society's demands (Table 2).

Summary of results

Participants based in both lithium-demanding and resource-rich countries attach significant importance to tools aimed at favoring the coexistence of mining and other regional economic activities, as well as the implementation of consultation mechanisms. The main difference emerges in the evaluation of legislative changes, with the former group ranking it as their top priority and the latter group positioning it in fifth place.

Analysis of responses across diverse stakeholder groups underscores a consensus, with all of them ranking tools aimed at fostering the coexistence of mining with other economic activities and the implementation of consultation mechanisms as their top two priorities. However, significant differences arise in the valuation of legislative changes, particularly regarding the mitigation of impacts on local social and cultural practices and ensuring that companies integrate civil society's demands. Participants from NGOs and academia highly prioritize such changes, in contrast to the perspective of government or industry members, who do not consider them as a priority (Table 2.2).

Social sustainability of lithium mining in salt flats. Most prioritized tools according to country of residence and group of belonging

Table 2.2

Social sustainability	Country of residence		Group			
	Rich in lithium resources in brine	Lithium-demanding	Government	Industry	NGO	Academia
Public policy instruments (ranking out of 7 possible)						
Conduct strategic and land use planning that favors the coexistence of lithium mining with other regional economic activities (e.g., tourism or agriculture).	1°	2°	1°	1°	2°	1°
Develop consultation mechanisms that incorporate the perspectives of the different stakeholders and are sensitive to cultural diversity (e.g., for prior consultation with indigenous peoples).	2°	2°	2°	2°	1°	2°
Create incentives for local job creation and training of local community members, especially favoring the inclusion of vulnerable groups.	3°	5°	3°	3°	6°	5°
Changes in legislation to ensure that companies incorporate the demands of civil society in the process of defining the terms under which lithium mining is carried out.	5°	1°	7°	6°	3°	3°
Multi-stakeholder consultation processes to agree on how to mitigate the negative impacts of lithium mining on the social and cultural practices of local communities.	4°	4°	4°	5°	4°	3°

Source: Delphi survey (Figures 12.2 and 12.3). Note: challenges that share the same position in the ranking obtained the same value in the ranking index that was built to process the responses.

As for the key actors that should lead the prioritized social sustainability initiatives, the panel assigns top priority to local communities, followed by the governments of producer countries at different levels. Additionally, universities and the scientific system, along with civil society actors and NGOs, are recognized as pivotal contributors.

Summary of results

Economic sustainability

Regarding the challenges to economic sustainability, the panel highlights the need to improve the participation of local communities in the economic benefits derived from lithium extraction. Simultaneously, there is a strong emphasis on the need to strengthen the link between lithium mining, the national economy and the scientific-technological system of resource-rich countries. This approach aims to stimulate the development of new productive and technological capabilities (Table 3).

Table 3. Economic sustainability of lithium mining in salt flats. Summary of the challenges and instruments most prioritized by the panel of respondents

Table 3

Priority challenges	Prioritized public policy instruments
1° Improve the participation of local communities in the economic benefits of lithium mining.	1° Public policies to promote the development of production and technological capabilities in mining countries (e.g., technology transfer agreements or setting conditions that facilitate the development of local suppliers).
2° Link lithium mining with the national economy and the scientific-technological system to build domestic capacities.	2° Participatory and multi-stakeholder consultation processes to agree on how to improve the participation of local communities in the economic benefits of lithium mining.
3° Increase transparency and facilitate access to economic and fiscal information on mining activity.	3° Increase technical capabilities and coordination between national and subnational public agencies with the mandate to monitor and produce information on lithium mining.

Source: Delphi survey results.

Regarding these two challenges, participants based in lithium-demanding countries assign higher priority to the issue of community participation in the economic benefits of mining, whereas the question of fostering technological linkages assumes a relatively lower priority. Conversely, for the group representing resource-rich countries, this relationship is reversed. Responses by membership group also differ. Those from NGOs and academia place higher importance on the issue of community participation, in contrast to those from the industry and, above all, the government, who assign it a substantially lower value. The latter two groups, industry and government, assign a higher value to the aspects of productive and technological linkages (Table 3.1).

In third place is the need to increase transparency and access to economic information related to lithium mining in salt flats. In relation to this challenge, the positions of the various actors differ: for NGO representatives this is a high-priority issue. In contrast, for academia, governments and, notably, industry participants, it holds a relatively lower position in their priorities.

Economic sustainability of lithium mining in salt flats. Most prioritized challenges according to country of residence and group of belonging

Tabla 3.1

Economic sustainability	Country of residence		Group			
	Rich in lithium resources in brine	Lithium-demanding	Government	Industry	NGO	Academia
Challenges (ranking out of 8 possible)						
Link lithium mining with the national economy and the scientific-technological system to build domestic capacities.	1°	2°	1°	1°	3°	2°
Improve the participation of local communities in the economic benefits of lithium mining.	2°	1°	2°	2°	1°	1°
Have human resources with the necessary skills to work in lithium mining.	3°	6°	5°	4°	5°	5°
Increase transparency and facilitate access to economic and fiscal information on mining activity.	6°	3°	5°	6°	2°	4°
Provide legal security and incentives for mining investment.	4°	6°	3°	3°	6°	6°
Improve the State's share of the economic rent from lithium mining.	5°	4°	4°	5°	4°	3°

Source: Delphi survey (Figures 14.2 and 14.3). Note: challenges that share the same position in the ranking obtained the same value in the ranking index that was built to process the responses.

To enhance community participation in the economic benefits of mining, a prominent proposal is the establishment of participatory processes and multi-stakeholder consultations to collectively devise mechanisms to meet this goal. Concerning the challenge of strengthening the link between lithium mining, the national economy and the scientific-technological system, the panel highlights the need to implement government policies promoting the development of capabilities in countries rich in lithium resources. This could involve agreements to transfer technology or the prerequisite of engaging local suppliers as a condition for accessing lithium resources (Table 3).

Analyzing disaggregated data according to the participants' stakeholder group shows significant disparities across all instrument options. Participants from industry, academia and government exhibit the most pronounced preference for the proposal oriented to the development of productive and technological capabilities. In contrast, an unusual alignment is observed in the high ratings provided by NGO and industry participants with regards to instruments oriented to the development of multi-stakeholder participatory processes to agree on the modalities of community participation in the economic benefits of mining. Conversely, this proposal receives a notably lower rating from government representatives.

Economic sustainability of lithium mining in salt flats. Most prioritized tools according to country of residence and group of belonging

Tabla 3.2

Economic sustainability	Country of residence		Group			
	Rich in lithium resources in brine	Lithium-demanding	Government	Industry	NGO	Academia
Public policy instruments (ranking out of 7 possible)						
Public policies to promote the development of production and technological capabilities in mining countries (e.g., technology transfer agreements or setting conditions that facilitate the development of local suppliers).	1°	3°	2°	1°	3°	1°
Increase technical capabilities and coordination between national and subnational public agencies with the mandate to monitor and produce information on lithium mining.	2°	3°	1°	3°	4°	2°
Participatory and multi-stakeholder consultation processes to agree on how to improve the participation of local communities in the economic benefits of lithium mining.	3°	2°	4°	2°	1°	1°
Changes in the regulatory and institutional framework to ensure greater participation of local communities in the economic benefits of lithium mining.	5°	1°	4°	5°	2°	3°
Changes in legislation to increase the State´s share (including state-owned companies) in the economic rent of lithium mining.	6°	5°	3°	7°	5°	6°
Educational and professional training policies to promote the acquisition of technical skills necessary for lithium mining.	4°	4°	3°	4°	6°	5°

Source: Delphi survey (Figures 15.2 and 15.3). Note: challenges that share the same position in the ranking obtained the same value in the ranking index that was built to process the responses.

In identifying the actors responsible for leading these initiatives, the panel, consistent with their stance on other sustainability dimensions, underscored the pivotal role that should be assumed by the governments of lithium-rich countries. Subsequently, civil society actors, including local communities and academia, are also recognized as essential contributors to this endeavor.

A just value chain for brine-based lithium-rich countries

In the survey, the panel was queried about conditions and obstacles associated with transitioning towards a lithium battery value chain that is just for the countries where lithium mining occurs. The

results highlight that, for the panel, the concept of justice is strongly linked to matters of economic sustainability.

According to the panel, the top-priority condition to be promoted involves enhancing the participation of local communities in the economic benefits derived from lithium mining. Subsequently, two conditions centered on lithium-demanding countries garner priority: first, these countries should encourage the enforcement of social and environmental standards where mining takes place, and second, they should prioritize the transfer of productive and technological capabilities to countries rich in lithium resources (Table 4).

A just lithium battery value chain. Summary of the conditions and obstacles most prioritized by the panel of respondents

Table 4

Prioritized conditions	Prioritized obstacles
1° Local communities derive economic benefits from lithium mining.	1° The institutional weaknesses and limited capacities of the state in lithium-rich countries do not guarantee compliance with sustainability standards in lithium mining.
2° Countries importing lithium promote compliance with social and environmental standards in countries where lithium mining takes place.	2° The asymmetry of resources between mining countries and downstream-operating countries (e.g. access to financial resources).
3° Countries importing lithium favor the transfer of production and technological capabilities to the countries where the resource is located.	3° The high demand for lithium encourages mining countries to export it with low added value.

Source: Delphi survey results (Figures 17.1 and 18.1).

Upon analyzing the responses based on the participants' country of residence, those from lithium-demanding countries prioritize conditions related to enhancing the well-being of local communities and changing consumption, production and mobility patterns (Table 4.1). Conversely, participants from lithium-rich countries, while agreeing that improving the participation of local communities in the economic benefits of mining is a priority, also underscore conditions aimed at fostering "downstream" developments in the value chain. Additionally, they consider it crucial that lithium-demanding countries facilitate the transfer of capabilities to nations rich in lithium resources (Table 4.1).

The analysis of responses regarding conditions, by membership group, reveals a notable degree of disparity (Table 4.1). Participants from the academia and the industry prioritize community participation in mining's economic benefits, while government participants prioritize capacity building and downstream activities development in the value chain. In contrast, NGOs consider a high priority making substantial changes in production, consumption and mobility patterns. Responses concerning the role of lithium-demanding countries also exhibit sharp variations. Industry participants underscore the responsibility of lithium-demanding countries in promoting social and environmental standards, differing from the perspectives of other groups as they assign considerably less weight to this issue.

A just value chain for brine-based lithium-rich countries

A just lithium battery value chain. Most prioritized conditions by country of residence and membership group

Table 4.1

A just lithium battery value chain	Country of residence		Group			
	Rich in lithium resources in brine	Lithium-demanding	Government	Industry	NGO	Academia
Conditions (ranking out of 9 possible)						
Local communities derive economic benefits from lithium mining.	1°	2°	3°	1°	4°	1°
Countries importing lithium favor the transfer of production and technological capabilities to the countries where the resource is located.	2°	6°	1°	5°	2°	4°
Mining countries succeed in developing downstream activities in the value chain (e.g., battery production).	2°	7°	2°	3°	5°	3°
Countries importing lithium promote compliance with social and environmental standards in countries where lithium mining takes place.	3°	4°	4°	2°	4°	5°
Local communities are involved in defining the terms under which lithium mining is carried out.	7°	1°	8°	8°	6°	2°
Significant changes in consumption, production and mobility patterns are promoted, especially in the developed economies, in order to reduce the demand for lithium and the pressures on territories.	6°	3°	6°	9°	1°	7°
The rights and culture of local communities are respected.	5°	5°	5°	4°	3°	7°

Source: Delphi survey (Figures 17.2 and 17.3). Note: challenges that share the same position in the ranking obtained the same value in the ranking index that was built to process the responses.

The panel was also asked about the obstacles that hinder the establishment of a lithium battery value chain that is just for the countries with active mining. The most frequently selected option points to

the institutional weaknesses and state capabilities of mining countries, which hinders compliance with adequate sustainability standards. The second most prevalent obstacle is, as highlighted by the panel, the asymmetry of resources between mining and lithium-demanding countries.

There were no significant differences in the responses based on the participants' place of residence (Table 4.2). Notably, both groups aligned in emphasizing the significance of resource asymmetry as an obstacle to constructing a more just value chain.

A just lithium battery value chain. Most prioritized conditions by country of residence and membership group.

Table 4.2

A just lithium battery value chain	Country of residence		Group			
	Rich in lithium resources in brine	Lithium-demanding	Government	Industry	NGO	Academia
Obstacles (ranking out of 7 possible)						
The institutional weaknesses and limited capacities of the state in lithium-rich countries do not guarantee compliance with sustainability standards in lithium mining.	1°	1°	1°	1°	1°	1°
The asymmetry of resources between mining countries and downstream-operating countries (e.g. access to financial resources).	2°	2°	2°	2°	4°	2°
The high demand for lithium encourages mining countries to export it with low added value.	3°	3°	5°	5°	2°	3°
Battery producing countries have a greater capacity to influence the definition of standards, which could lead to these standards being biased in favor of their interests.	3°	5°	3°	6°	6°	5°
There are insufficient regulatory or economic incentives for companies to develop their activities under stricter social and environmental sustainability standards.	5°	4°	6°	3°	5°	6°
Countries with lithium brine resources adopt low sustainability standards.	5°	5°	4°	7°	3°	4°

Source: Delphi survey (Figures 18.2 and 18.3). Note: challenges that share the same position in the ranking obtained the same value in the ranking index that was built to process the responses.

The breakdown by participants' stakeholder group shows a scenario of relative uniformity in terms of the importance assigned to the issue of institutional weaknesses and the capabilities of mining countries. This option received the highest level of prioritization across all groups. Regarding the obstacle of resource asymmetry, academia, governments, and industry participants showed similar perspectives, ranking it as their second-choice option. Conversely, NGO participants emphasize the growing demand for lithium as the most important obstacle. This is because the high demand incentivises mining countries to exploit the resource with low added value.

Results

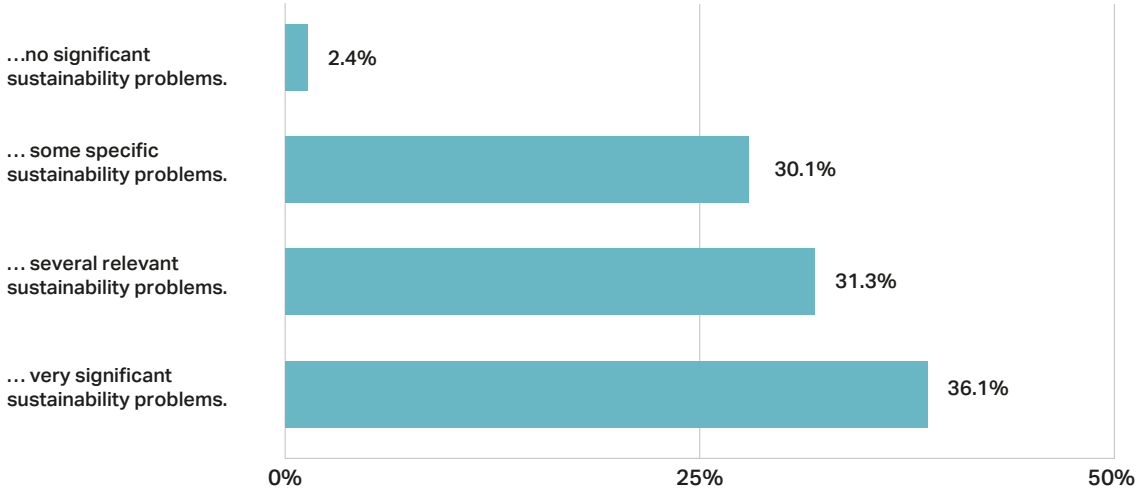
Sustainability of lithium mining in salt flats

The survey begins with two general questions regarding the sustainability of lithium mining in salt flats and its governance. The results convey two clear messages. Firstly, the majority of the panel (67%) expresses the view that lithium mining in salt flats presents significant sustainability problems: whereas 31.3% of the respondents consider that it has several relevant problems, 36.1% rate these sustainability problems as very significant (Figure 3.1).

Sustainability problems of lithium mining

Taking into account the information reported so far on results of Round 1, you would say that lithium mining in salt flats has

Figure 3.1

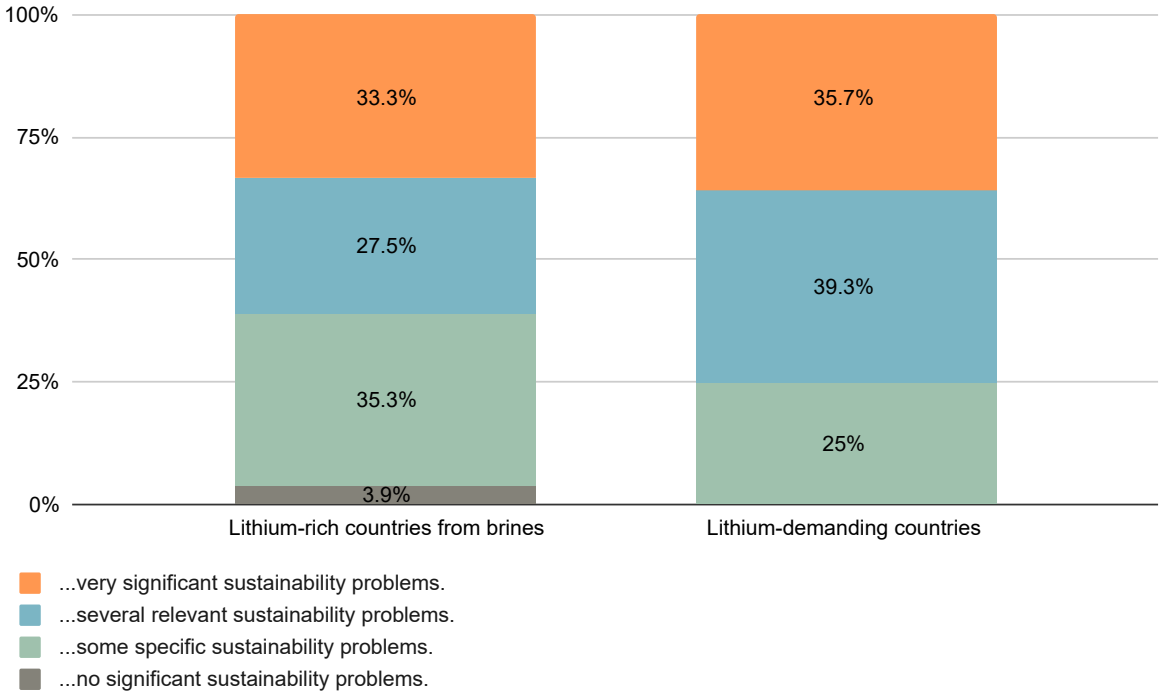


When analyzing the responses based on the participants´ country of residence, it is observed that residents in lithium-demanding countries provide more critical assessments of sustainability challenges compared to those residing in brine-based lithium-rich countries (Figure 3.2).

Sustainability of lithium mining in salt flats

Sustainability problems of lithium mining according to the country of residence of the panelists (*)

Figure 3.2



(*) Methodological note: the graph shows the distribution of responses according to the panelists' country of residence. The extension of the bar reaches 100% because it disaggregates the total responses within a group. The color code indicates what percentage of the group chose that response option.

When analyzing responses by respondent group, notable disparities come to light (Figure 3.3). Participants from NGOs exhibit the highest degree of concern regarding sustainability problems associated with lithium mining, with a substantial 66% deeming them as "very significant". In contrast, industry respondents display a significantly milder perspective, with only 13% highlighting "very significant problems" and 46% noting "some specific problems". It is worth taking notice that industry participants were the only ones who provided responses in the category "no significant sustainability problems" (13%). Participants from the academia and government groups have maintained, in general terms, opinions more in line with those of the NGOs: 84% of government representatives indicated several relevant or very significant problems compared to 68% from academia. However, in the latter case, the weight of the "very significant problems" option (37%) is greater than that of governments (31%) (Figure 3.3).

Sustainability of lithium mining in salt flats

Sustainability problems of lithium mining per membership group (*)

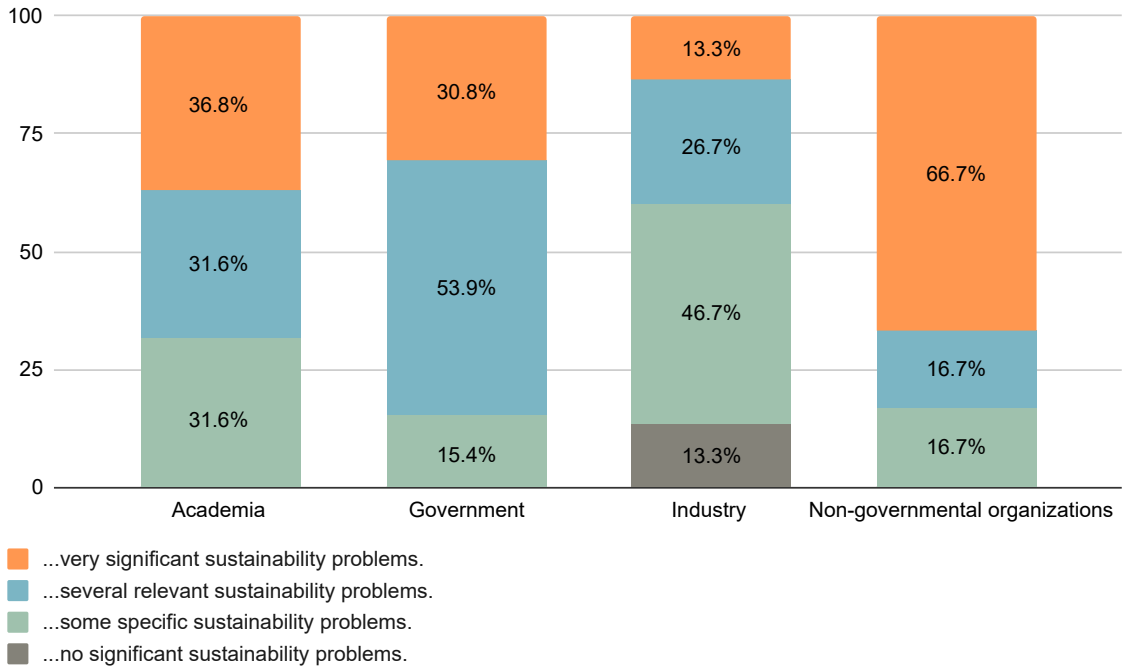


Figure 3.3

(*) Methodological note: the graph shows the distribution of responses per membership group. The extension of the bar reaches 100% because it disaggregates the total responses within a group. The color code indicates what percentage of the group chose that response option.

The second message from the survey underlines agreement within the panel on the imperative need to tackle sustainability concerns in lithium projects, i.e. they agree that business as usual is not an option. A substantial 77% of respondents concur that measures should be implemented even if it means slowing down the pace of expansion (56.6%) or suspending the activity completely (20.5%) (Figure 4.1).

Sustainability and courses of action for lithium mining

Taking this information into account, what do you think is the most appropriate course of action from the point of view of lithium mining sustainability in salt flats?

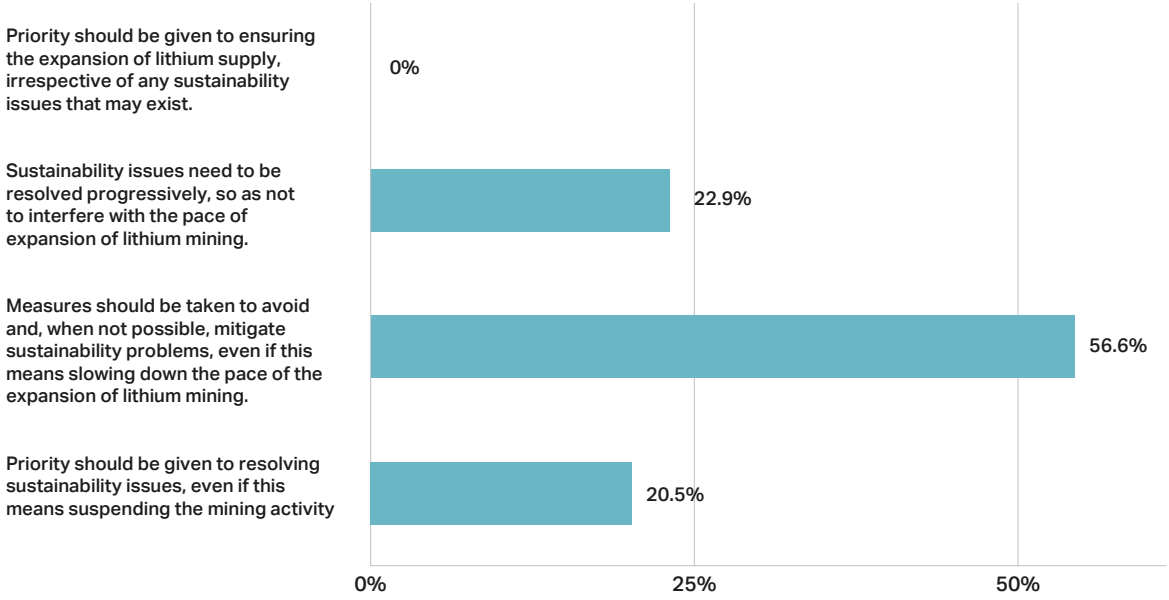


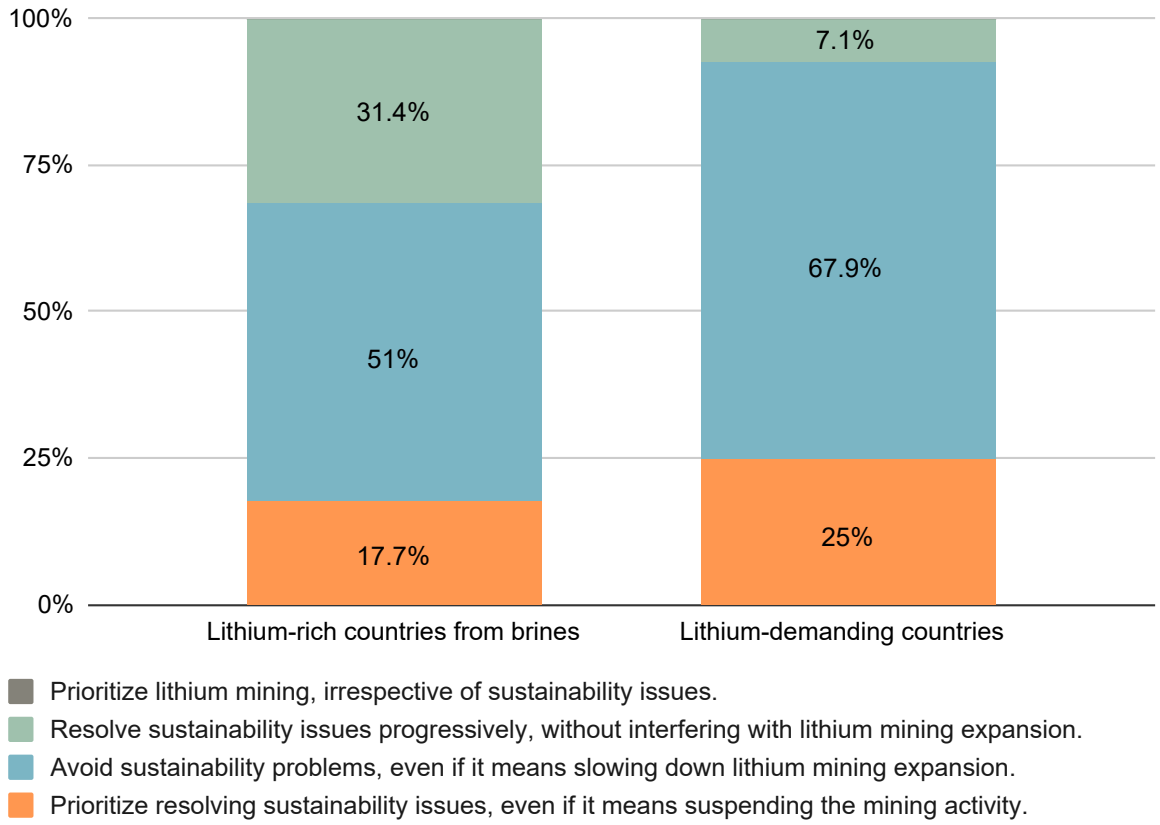
Figure 4.1

Sustainability of lithium mining in salt flats

In line with the responses to the first question previously analyzed, participants from countries with a high demand for lithium underscore a stronger commitment to addressing sustainability concerns. A noteworthy 92% within this group align with options advocating such actions, even if it means slowing down the pace of activity expansion or suspending it altogether. In contrast, in the case of lithium-rich countries, these options account for 68% and 31% of respondents choose the option of solving sustainability problems without interfering with the expansion of lithium mining (Figure 4.2).

Figure 4.2

Sustainability and courses of action for lithium mining according to the country of residence of the panelists (*)



(*) Methodological note: the graph shows the distribution of responses according to the panelists' country of residence. The extension of the bar reaches 100% because it disaggregates the total responses within a group. The color code indicates what percentage of the group chose that response option.

Examining responses per membership group reveals that all stakeholders chose avoiding sustainability problems as the leading course of action, even if it results in a slowdown of lithium mining expansion. Percentages vary slightly, with academia at 60%, industry and government at 53%, and NGOs at 50% (Figure 4.3). However, secondary preferences differ based on the group of belonging. In the case of industry and government participants, priority is given to solving sustainability problems without interfering with mining expansion, with 46% and 38%, respectively. This contrasts with participants from NGOs and academia, where 50% and 23%, respectively prioritize sustainability as a secondary option, even if it entails suspending the mining activity.

Finally, two extreme cases are worth paying attention to. First, among industry representatives, none opt for the latter course of action. Second, NGOs are the sole group whose members refrain from choosing the path of "solving sustainability problems without interfering with the pace of lithium mining expansion". In summary, we see that NGOs and academia take a more rigid position, showing a willingness to decelerate or suspend activities. This contrasts with the positions of industry and

government representatives, who are more inclined toward addressing sustainability challenges concurrently with the development of lithium mining.

Sustainability and courses of action for lithium mining per membership group (*)

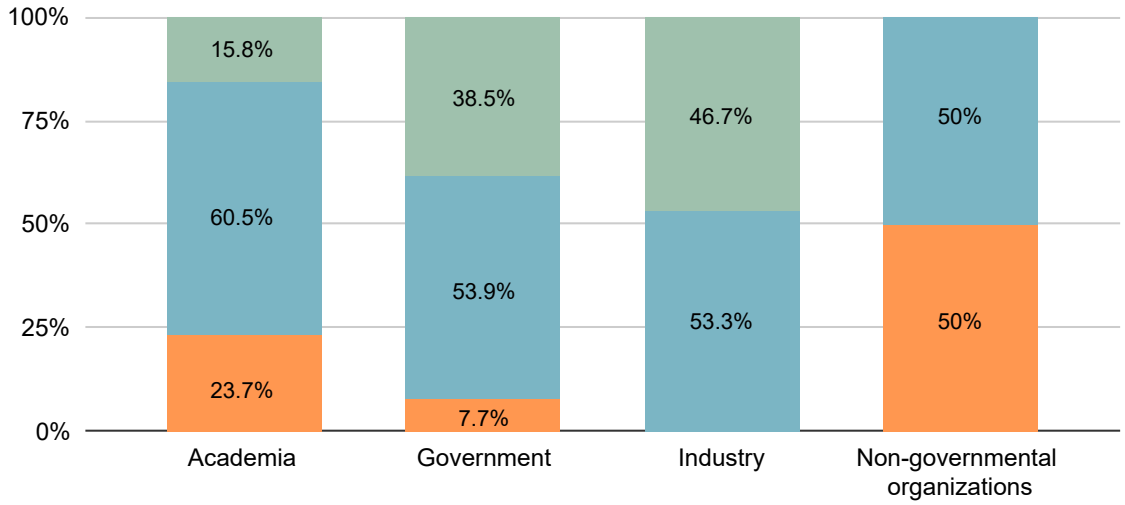


Figure 4.3

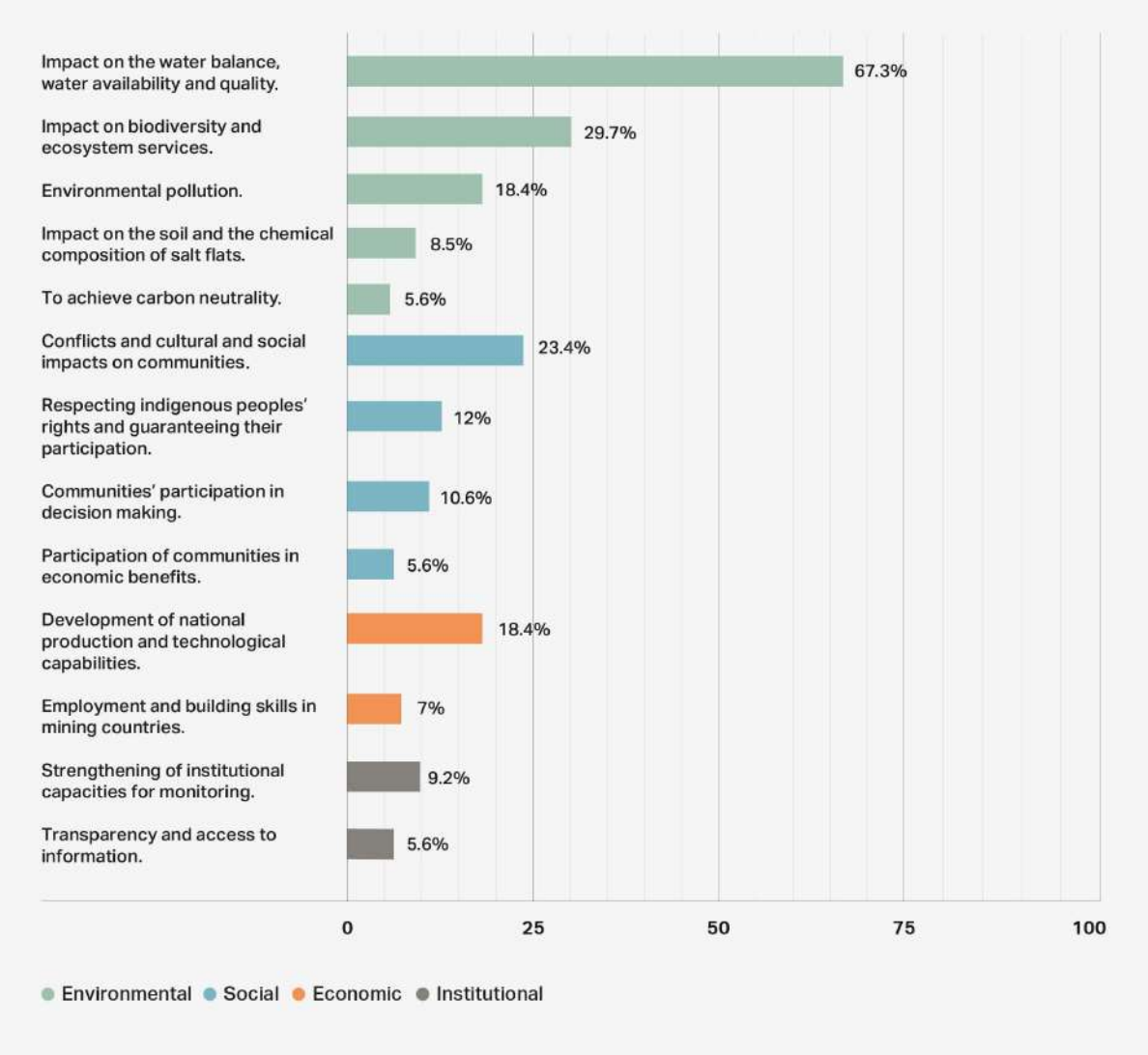
- Priority should be given to ensuring the expansion of lithium supply, irrespective of any sustainability issues that may exist.
- Sustainability issues need to be resolved progressively, so as not to interfere with the pace of expansion of lithium mining.
- Measures should be taken to avoid and, when not possible, mitigate sustainability problems, even if this means slowing down the pace of the expansion of lithium mining.
- Priority should be given to resolving sustainability issues, even if this means suspending the mining activity.

(*) Methodological note: the graph shows the distribution of responses per membership group. The extension of the bar reaches 100% because it disaggregates the total responses within a group. The color code indicates what percentage of the group chose that response option.

In the first round of the survey, the panel was presented with an open question: “Which are the main sustainability challenges of lithium mining in salt flats?” After coding the responses, findings tell us that, according to the participants, the main challenges correspond to environmental issues, followed by social and economic challenges, and finally, those concerning institutional issues related to the governance of mining sustainability (Figure 5).

Main challenges for the sustainability of lithium mining in salt flats (Round 1) (*)

Figure 5



(*) Methodological note: On the left side of the graph, you can observe the categories derived from the coding process. The numbers at the end of each bar represent the percentage of the panel that included the respective category in their responses. Environmental challenges are represented by the green bars, while social, economic, and institutional challenges are represented by the blue, orange, and gray bars. It is important to note that the total percentage for each category exceeds 100% because participants were allowed to provide multiple answers. Categories with a participation rate of less than 5% in the aggregate responses of the panel are not reported.

Among the environmental challenges, the impact on the water balance, availability and quality of water in the basins of the salt flats stands out, as pointed out by 67.3% of the participants. In second place is the impact on biodiversity and the ecosystems where the salt flats are located, with 29.7%. The prioritization of environmental challenges is ratified in Round 2, where the panel was tasked with expressing their level of agreement with various statements, derived from the responses to the open-ended question in Round 1. The respondents used a scale from 1 to 7, with 7 indicating "strongly agree". The results show that 91.5% of the panel agrees with the statement: "It is necessary to develop new production processes in lithium mining in salt flats that have a low impact on water availability and on the biodiversity of the territories where it is carried out". The level of agreement on this issue is reflected in the 61.4% who choose the "strongly agree" option (Figure 6.1). In the same sense, 68% of the panel expresses varying degrees of agreement with the statement "Currently, there is a lack of sufficient information and reliable models to evaluate the impact of freshwater and brine pumping associated with lithium mining on the hydrological balance of the salt flats and the basin where they are located" (Figure 6.1).

Statements presented to the panel to express agreement or disagreement (*)

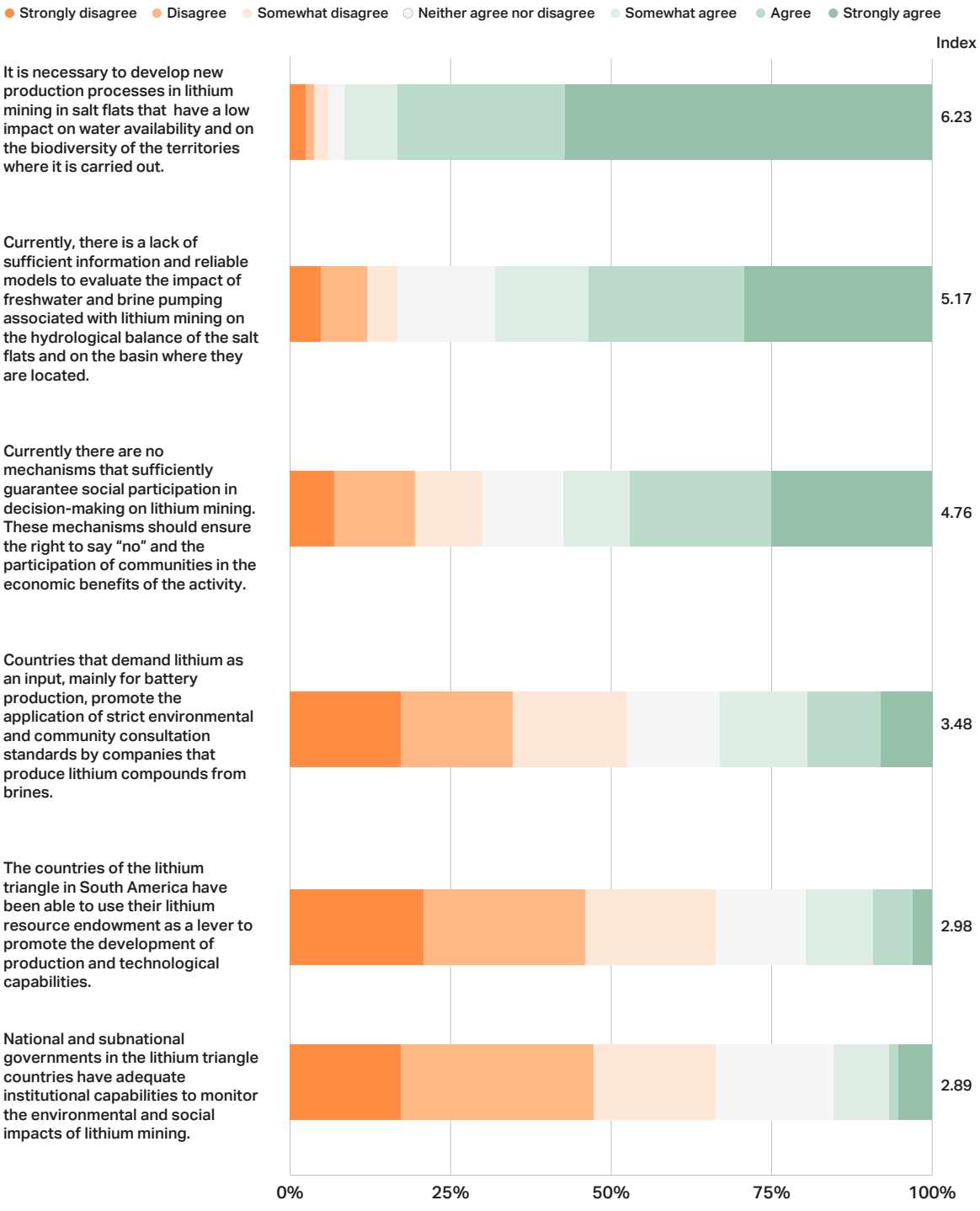


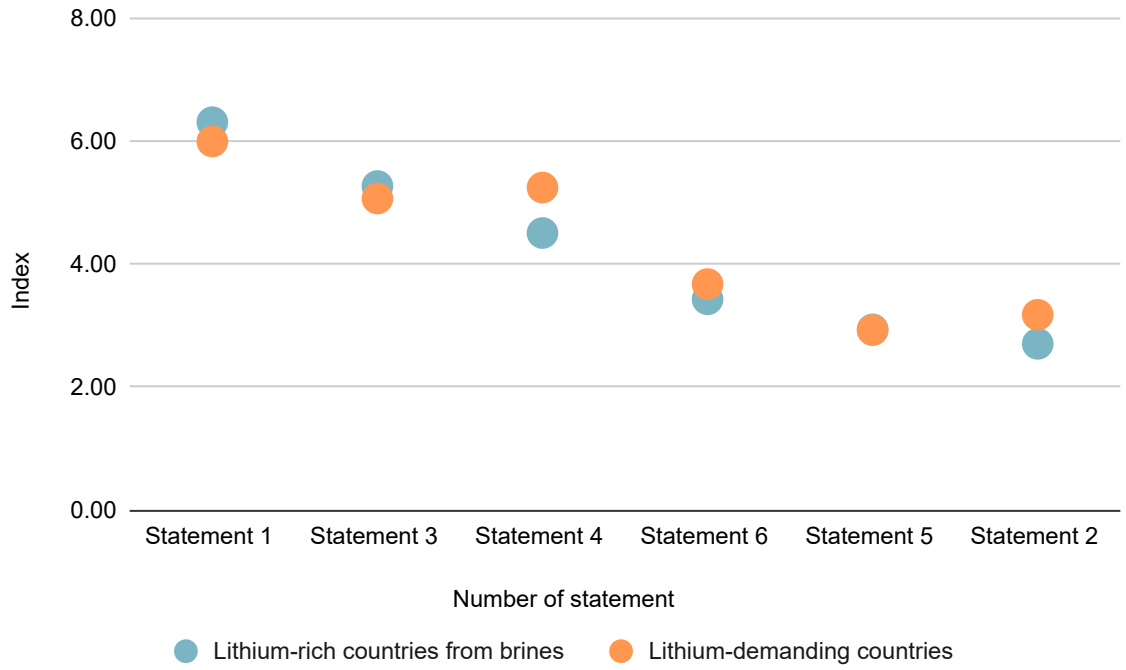
Figure 6.1

(*) Methodological note: responses are expressed on a scale of 1 to 7, with 1 being "strongly disagree" and 7 being "strongly agree". The index corresponds to the simple average of the responses.

Upon examining the responses from the panelists based on their country of residence and groups of belonging, no significant differences were observed (Figures 6.2 and 6.3). However, it is worth noting that government participants exhibited the highest degree of agreement across all groups with the statement "Currently, there is a lack of sufficient information and reliable models to evaluate the impact of freshwater and brine pumping associated with lithium mining on the hydrological balance of the salt flats and the basin where they are located" (Statement 3, Figure 6.3). In summary, these results indicate that there is a high level of agreement in the panel on the deficient current state of knowledge regarding the environmental impacts of lithium mining, especially on the water basin, and the need to develop process innovations that avoid or mitigate this impact as much as possible.

Figure 6.2

Degree of agreement with the statements according to the country of residence of the panelists (*)



(*) Methodological note: The index reported on the vertical axis corresponds to the simple average of the panelists' responses, which are expressed on a scale of 1 to 7, with 1 being "strongly disagree" and 7 "strongly agree". The colored dots represent the value of the index for each statement according to the group of respondents.

Table 5

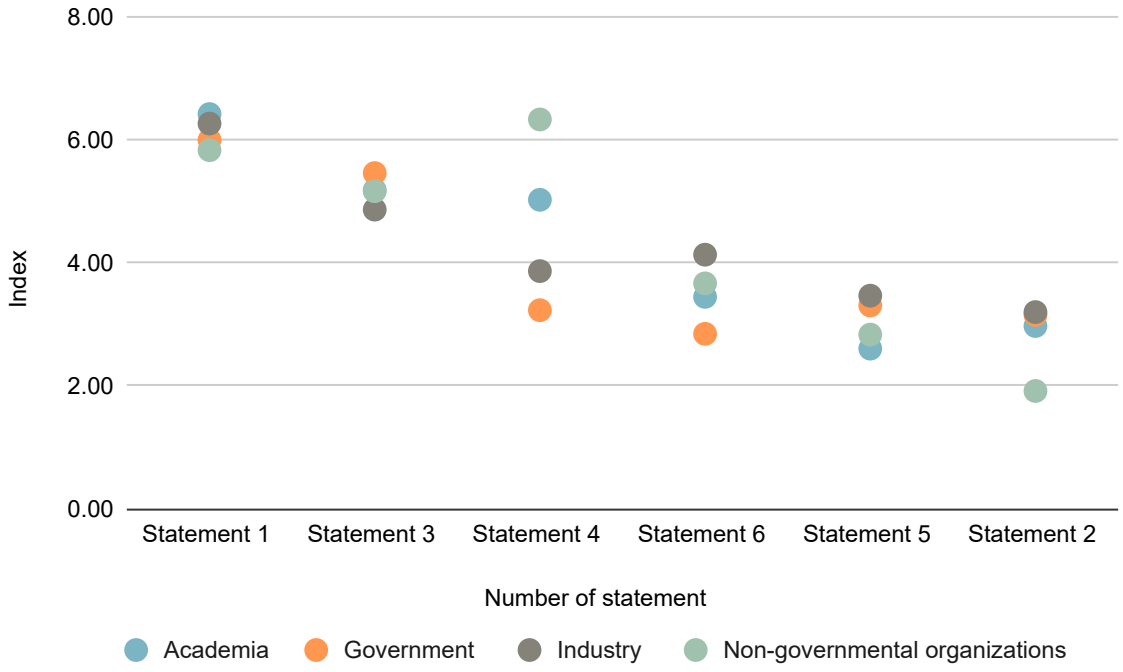
References of the statements presented to the panel

N°	Statement
1	It is necessary to develop new production processes in lithium mining in salt flats that have a low impact on water availability and on the biodiversity of the territories where it is carried out.
2	National and subnational governments in the lithium triangle countries have adequate institutional capacities to monitor the environmental and social impacts of lithium mining.
3	Currently, there is a lack of sufficient information and reliable models to evaluate the impact of freshwater and brine pumping associated with lithium mining on the hydrological balance of the salt flats and the basin where they are located.

4	Currently there are no mechanisms that sufficiently guarantee social participation in decision-making on lithium mining. These mechanisms should ensure the right to say "no" and the participation of communities in the economic benefits of the activity.
5	The countries of the lithium triangle in South America have been able to use their lithium resource endowment as a lever to promote the development of production and technological capabilities.
6	Countries that demand lithium as an input, mainly for battery production, promote the application of strict environmental and community consultation standards by companies that produce lithium compounds from brines.

Figure 6.3

Degree of agreement with the statements per membership group (*)



(*) Methodological note: The index reported on the vertical axis corresponds to the simple average of the panelists' responses, which are expressed on a scale of 1 to 7, with 1 being "strongly disagree" and 7 "strongly agree". The colored dots represent the value of the index for each statement according to the group of respondents.

Returning to the open consultation conducted in Round 1, the second level of importance, following environmental challenges, revolves around the challenges to social sustainability (Figure 5). According to the panel, the most relevant challenges pertain to the impacts of lithium mining on the cultural and social practices of local communities (23.4%) and the ability to guarantee respect for their rights, including participation and free, prior and informed consultation with indigenous peoples (12%).

In Round 2, the question of community consultation was explored by asking the panelists to express their degree of agreement with the statement: "Currently there are no mechanisms that sufficiently guarantee social participation in decision-making on lithium mining. These mechanisms should ensure the right to say "no" and the participation of communities in the economic benefits of the activity". A significant 57% of the panel expressed concurrence with this statement, while 30% showed varying levels of disagreement (Figure 6.1).

When analyzing responses based on participants' country of residence, it is observed that those stemming from lithium-demanding countries exhibit a higher degree of agreement with this statement compared to representatives from lithium-rich countries (Statement 4, Figure 6.2). Examining the responses by stakeholder group reveals remarkable disparities. On one extreme, respondents from

NGOs strongly agree with the statement (with an index higher than 6 on the scale). On the other extreme, government participants and, to a lesser degree, industry representatives, disagreed with the statement (index lower than 4) (Statement 4, Figure 6.3).

Likewise, when the panel was queried about their level of agreement with the statement that countries that demand lithium promote the application of strict environmental standards and community consultation by companies that produce lithium compounds, the response was in line with the previous ones: a slight majority (54%) expressed disagreement, compared to 31% who agreed (Figure 6.1). Analyzing the responses by stakeholders' affiliation reveals a marked difference between industry and government participants (something that does not occur with the other statements), which are located at the two extremes of the range with industry expressing agreement and government showing disagreement with the statement (Statement 6, Figure 6.3).

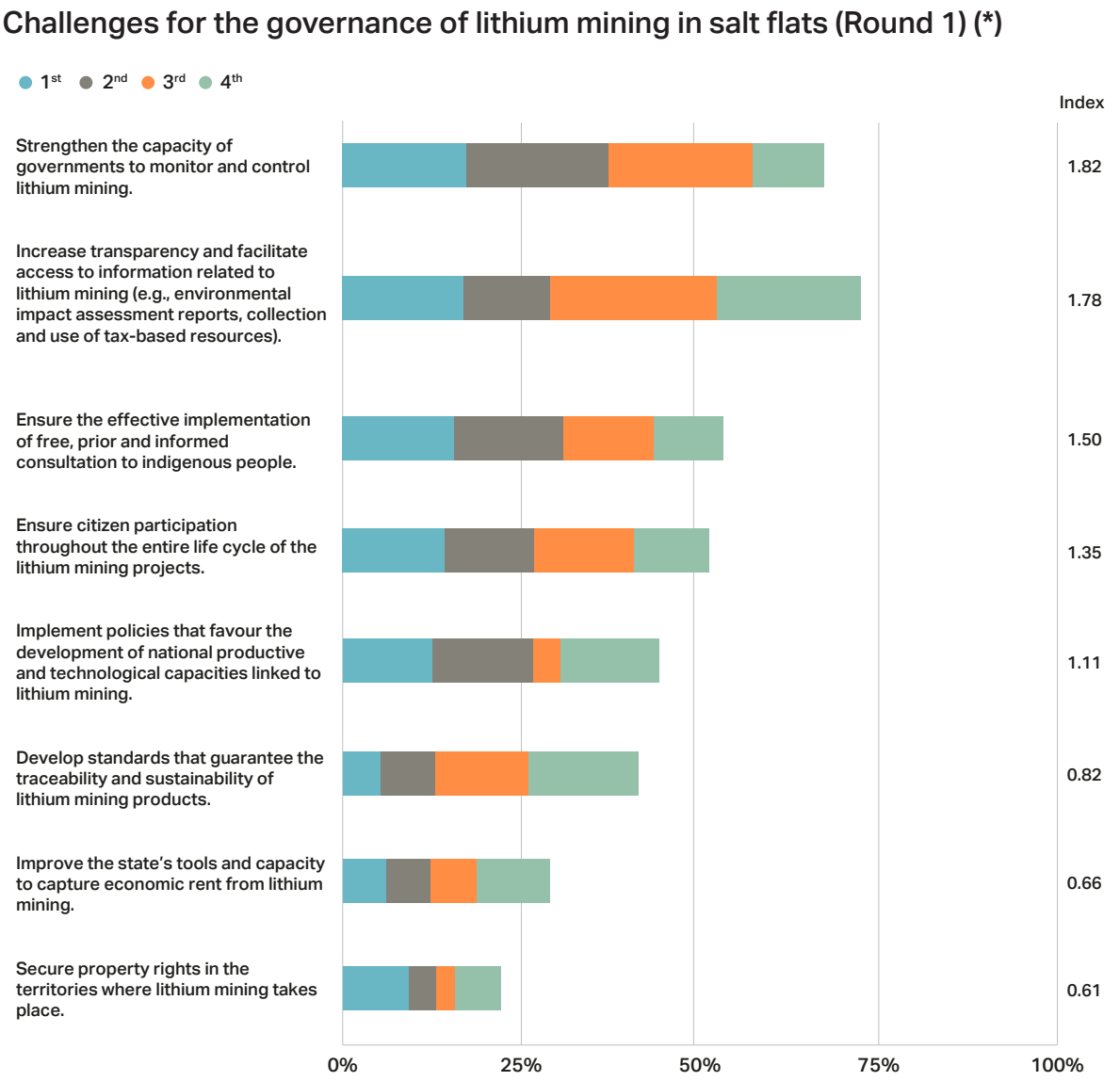
As observed in the open question posed in Round 1 regarding sustainability challenges, concerns related to the economic sustainability of lithium mining in salt flats take the third position in importance (Figure 5). Within this dimension, the challenge of developing national productive and technological capabilities stands out. The perception of a shortfall in this field was ratified in Round 2, with 67% of the panel expressing varying degrees of disagreement with the following statement: "The countries of the lithium triangle in South America have been able to use their lithium resource endowment as a lever to promote the development of production and technological capabilities". Only 19% of the panel expresses different levels of agreement with this statement (Figure 6.1). In this area, very homogeneous results are observed, both when analyzing the responses by country of residence, as well as when analyzing them by stakeholder group (Statement 5, Figures 6.2 and 6.3).

The fourth sustainability challenge identified in the open consultation in Round 1 relates to the governance of lithium mining (Figure 5). The panel underlines the need to strengthen government monitoring and control capabilities, increase transparency and facilitate access to information on the activity. The importance of the first point is ratified in Round 2. During this phase, over two thirds of the panel (68.6%) expressed varying degrees of disagreement with the statement: "National and subnational governments in the lithium triangle countries have adequate institutional capacities to monitor the environmental and social impacts of lithium mining" (Figure 6.1).

When analyzing the variations in responses based on the participants' country of residence, it is observed that the respondents from lithium-rich countries present, in comparison with those residing in lithium-demanding countries, a higher level of disagreement with the statement that suggests that the institutional capabilities to monitor the environmental and social impacts of lithium mining are adequate (Statement 2, Figure 6.2). About the responses by stakeholders' group, participants from NGOs attach the most significance to the option positing that governments lack these capacities (Statement 2, Figure 6.3). However, it's important to emphasize that, to varying degrees, all groups share this perspective.

The responses to the open-ended question on sustainability (Figure 5) align with the findings from a closed-ended question about governance, which was also administered in Round 1. The panel was asked to identify the primary challenges concerning the governance of lithium mining in salt flats (Figure 7). In addition to the previously mentioned challenges, two significant issues were underscored as focal points, both pertaining to the engagement of civil society in shaping the terms under which mining activities are conducted: firstly, prior, free and informed consultation with indigenous peoples; and secondly, the implementation of mechanisms that encourage citizen participation throughout the life cycle of mining projects (Figure 7).

Figure 7



(*) Methodological note: the spread of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The reported index in the right column summarizes the information obtained and ranks the challenges: it was calculated by assigning to the answer a value of 4 when the option was chosen first, 3 if it was second-elected, 2 if third-elected, 1 if fourth-elected, and 0 if unelected. Then a simple average of these values was calculated.

Environmental Sustainability

To rank the main challenges associated with lithium mining in salt flats, the panel was presented with a series of questions offering closed options indicating different types of challenges. Participants were then asked to rank the options by level of importance. Regarding the environmental dimension, the outcomes closely mirror those obtained from the open-ended question examined in the previous section (Figure 5). According to the panel, the most prioritized challenge refers to avoiding or mitigating the impact of lithium mining on the water balance of the basin where the salt flats are located. The second option with the highest significance highlights the need to avoid or mitigate the impact of mining on the biodiversity of the ecosystems where the activity takes place (Figure 8.1).

Environmental sustainability

Data breakdown by participants' country of residence does not show significant differences with respect to these options (Figure 8.2). When examining the data by group affiliation, the disparities observed are notably smaller than those witnessed in other dimensions of sustainability discussed below (Figure 8.3). Regarding the question of the impact of lithium mining on the water balance of the basin where the salt flats are located, there is a greater prioritization by participants from academia, followed by those from NGOs and industry, and lastly by governments. Despite these differences, for all membership groups, this issue occupies the highest level of prioritization (Option A, Figure 8.3). On the contrary, in the case of the impact on biodiversity, industry and government participants place this challenge as their top priority, while NGOs accord it the least importance (Option B, Figure 8.3).

In the analysis of the challenges, two noteworthy results, despite receiving a low level of prioritization by the panel, sparked discussion in the workshops analyzing the survey outcomes. Furthermore, both issues play an important role in the strategy of lithium-demanding countries (especially in Europe) (Figure 8.1). The first concerns the strategy of increasing battery recycling to promote the circular economy thus reducing the dependence on external sources of raw material supply. The second concerns the goal of "achieving carbon neutrality of lithium mining". Concerning recycling, it's clear that lithium-demanding countries, driven by their pursuit of reduced dependence on primary raw material sources, accord a relatively higher level of importance to this challenge (Option G, Figure 8.2). However, this is not the case regarding the carbon neutrality of lithium mining in salt flats, even though the issue is very high on the political agenda of lithium-demanding countries. For example, the European Union has set carbon neutrality targets established in the Green Deal and the European Climate Law. One potential explanation for the lower prioritization of this issue could be attributed to the fact that lithium mining in salt flats tends to have comparatively lower carbon emissions in contrast to mining operations in other types of deposits.

Environmental sustainability

Main challenges for the environmental sustainability of lithium mining in salt flats (*)

Taking this information into account, which of the following environmental sustainability challenges should be addressed as a priority? Rank them from 1 to 3 (1 being the most important).

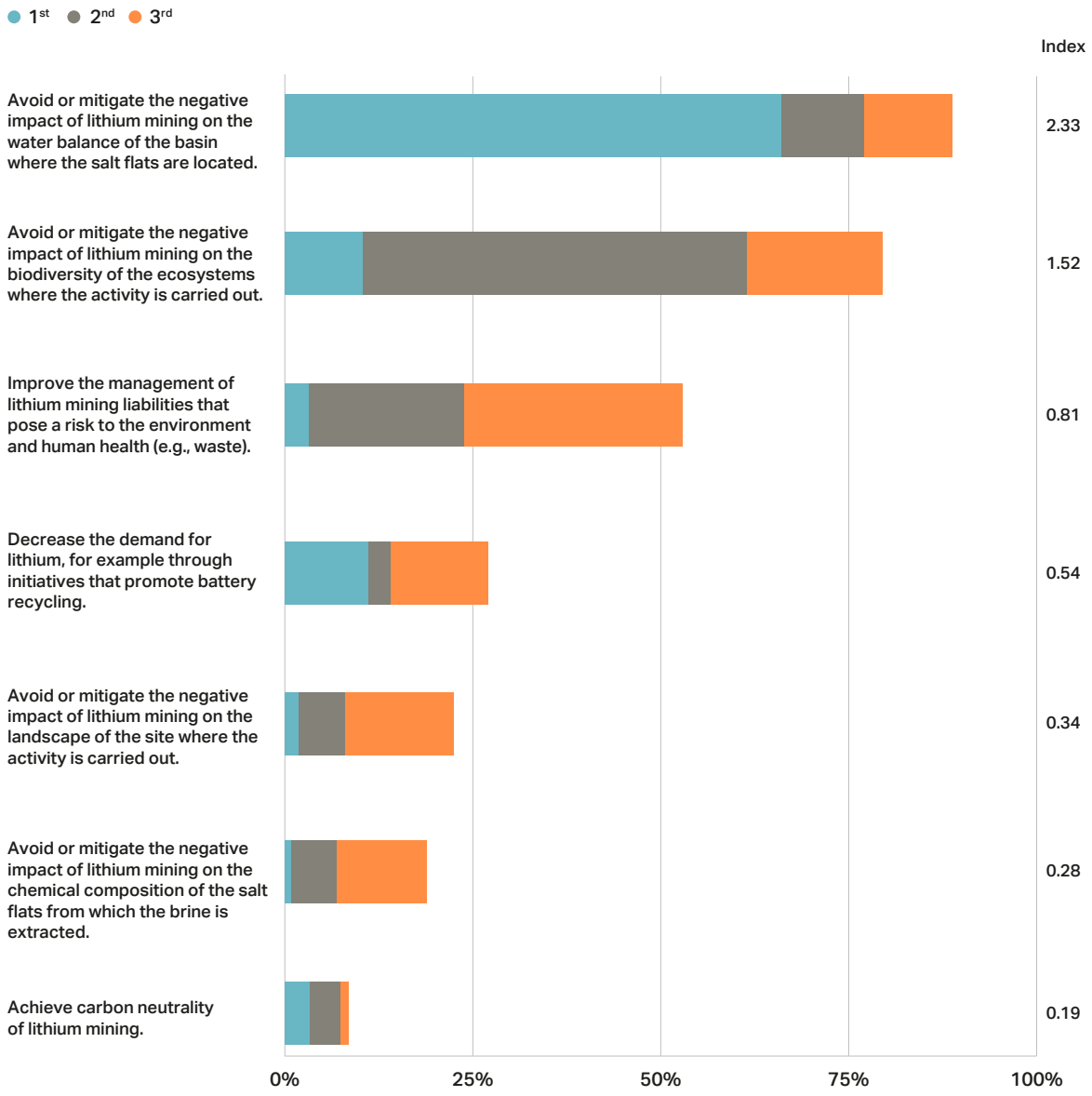


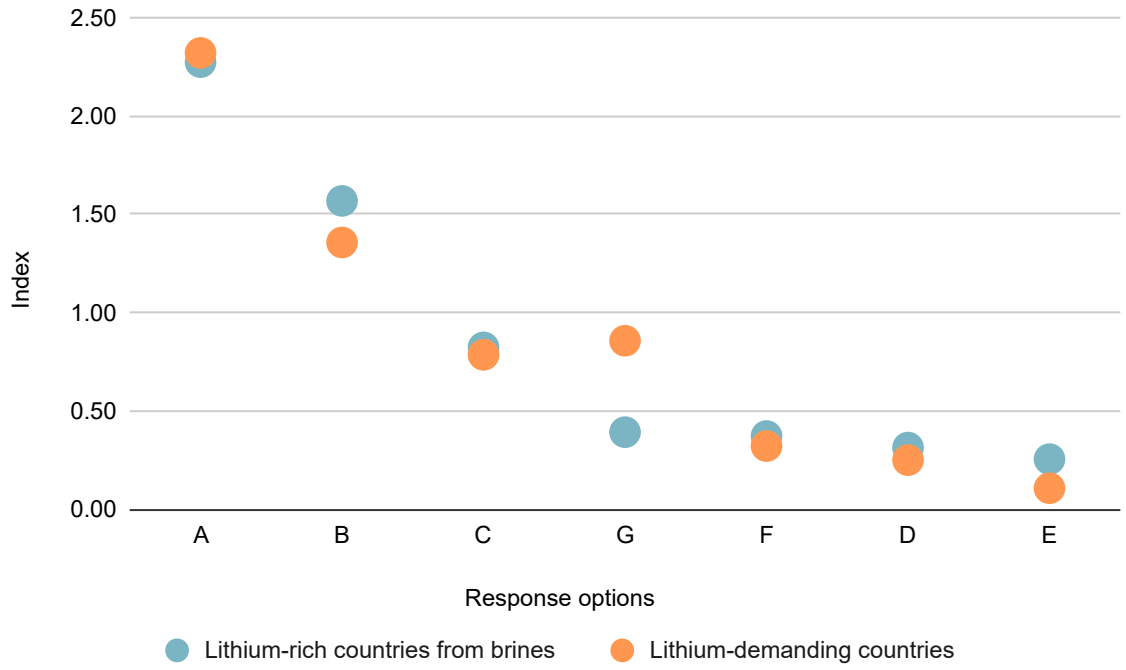
Figure 8.1

(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc). The index reported in the right column summarizes the information obtained and ranks the challenges. It was calculated assigning each response a value of 3 when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then calculated.

Environmental sustainability

Main challenges for the environmental sustainability of lithium mining in salt flats according to the country of residence of the panelists (*)

Figure 8.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

References. Response options for figures 8.2 and 8.3.

Table 6

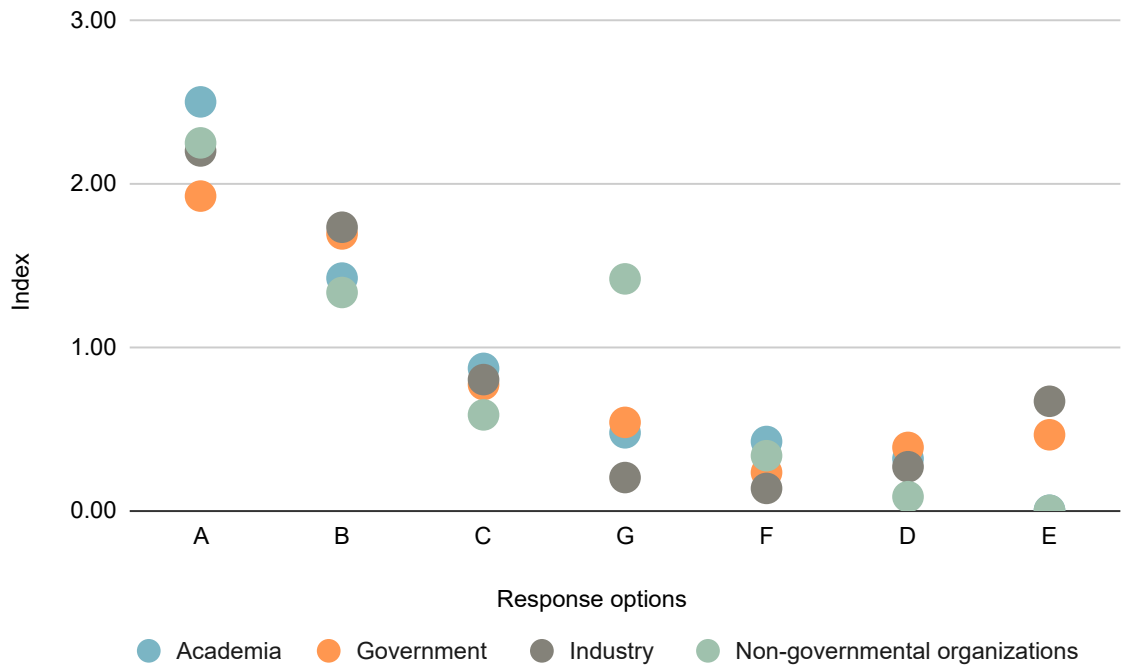
Reference	Option
A	Avoid or mitigate the negative impact of lithium mining on the water balance of the basin where the salt flats are located.
B	Avoid or mitigate the negative impact of lithium mining on the biodiversity of the ecosystems where the activity is carried out.
C	Improve the management of lithium mining liabilities that pose a risk to the environment and human health (e.g., waste).
D	Avoid or mitigate the negative impact of lithium mining on the chemical composition of the salt flats from which the brine is extracted.
E	Achieve carbon neutrality of lithium mining.
F	Avoid or mitigate the negative impact of lithium mining on the landscape of the site where the activity is carried out.
G	Decrease the demand for lithium, for example through initiatives that promote battery recycling.

In the responses broken down by stakeholders' group, the issue of recycling is clearly a priority only for NGO representatives (Option G, Figure 8.3). The challenge of achieving carbon neutrality was considered a relatively high priority by industry and government participants only. Representatives associated with NGOs considered it the lowest priority challenge, and none of the participating

academia panelists chose it as a priority issue among the available response options (Option E, Figure 8.3).

Figure 8.3

Main challenges for the environmental sustainability of lithium mining in salt flats per membership group (*)



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

The second question within the environmental dimension concerns public policies or tools that should be implemented to address the challenges with the highest ranking. The panel's responses give high priority to a set of measures aimed at increasing state investment (Figure 9.1). The focus of these actions, according to the participants, should be on improving the generation and transparency of environmental information (priority order 1). Following this, there is an emphasis on increasing the capacity to enforce compliance with environmental standards (priority order 3). Finally, investment should be directed toward the development of new extractive technologies that reduce the impacts of mining on the water balance and biodiversity (priority order 4). This set of actions, aimed at increasing public investment, closely align with the environmental challenges identified above (Figure 8.1), as well as with the deficit in the state's capacity to monitor and control mining activity discussed in the previous section (Figure 6.1).

Environmental sustainability

Public policies or tools that should be implemented as a priority to address the environmental sustainability challenges (*)

Which of the following public policy initiatives or tools should be implemented as a priority to address these challenges to environmental sustainability? Select the three most important ones, ranking them from 1 to 3 (1 being the most important).

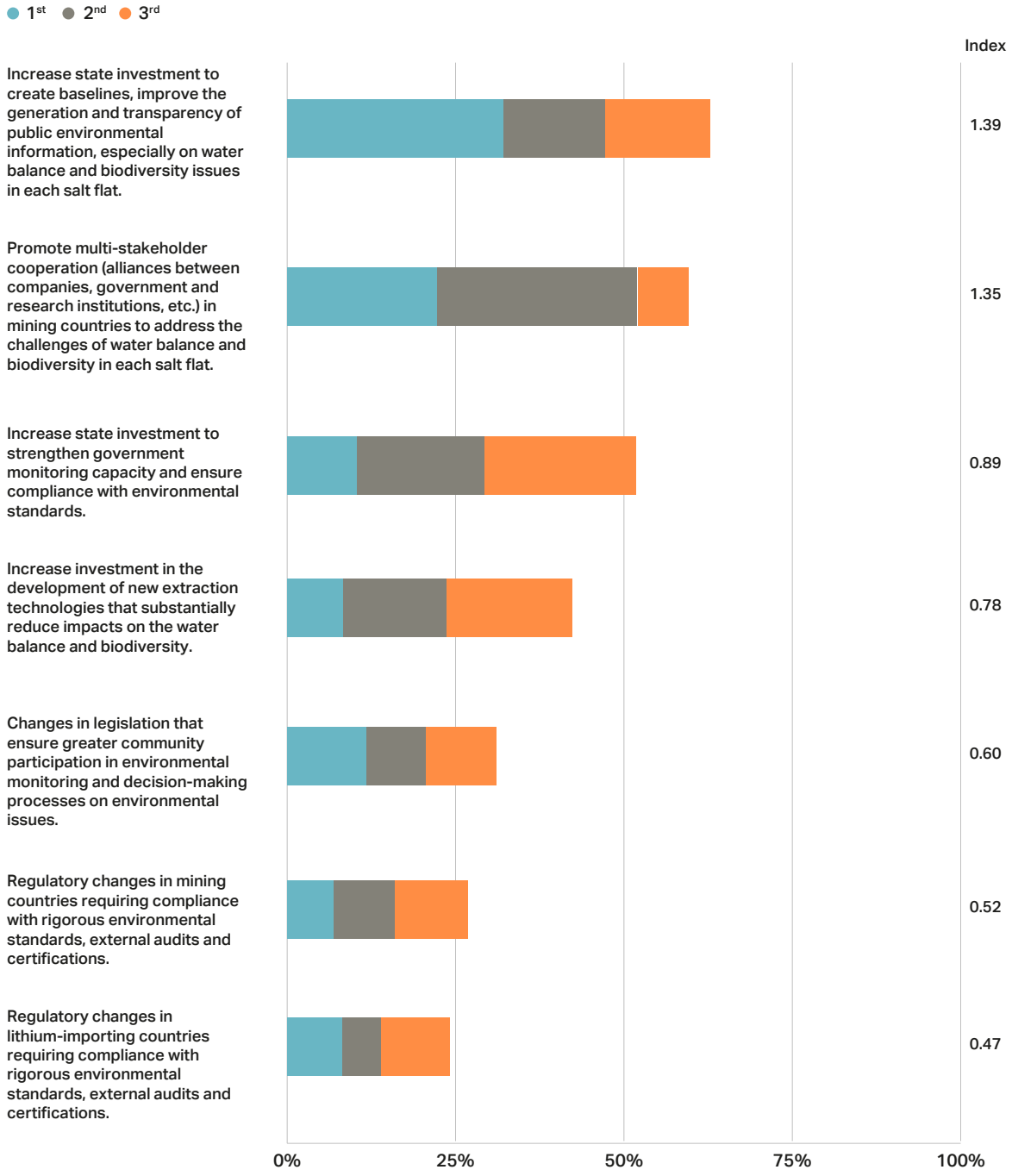


Figure 9.1

(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc). The index reported in the right column summarizes the information obtained and ranks the challenges. It was calculated assigning each response a value of 3 when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then calculated.

Environmental sustainability

The priorities assigned to each of these measures to increase state investment differ by country of residence and stakeholders' group. Participants from countries abundant in lithium resources emphasize more matters related to information (priority order 1) and technologies (priority order 4) aimed at enhancing sustainability conditions (Options A and E, Figure 9.2). In contrast, the need to strengthen state control capabilities (Option C, Figure 9.2) is highlighted almost equally by both groups.

Significant differences are observed per membership group. Government and academia representatives stand out for their preference for focusing on the generation and transparency of environmental information (Option A, Figure 9.3.). Conversely, industry and NGO participants give low priority to the production of information as a mechanism to address environmental challenges. Industry (and government) participants lean towards multi-stakeholder cooperation mechanisms while NGO representatives prioritize regulatory changes instead (Options B and G respectively, Figure 9.3).

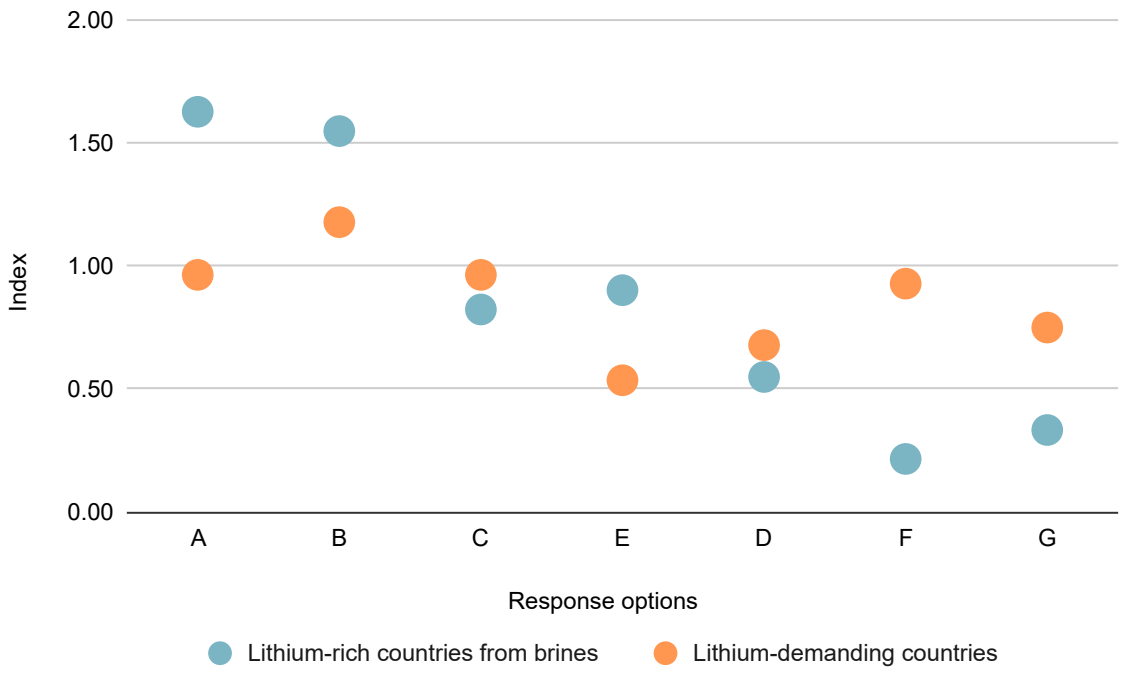
Regarding increased state investment to strengthen governmental monitoring capabilities and to ensure compliance with environmental standards, two pieces of data stand out (Option C, Figure 9.3). First, the low priority given by participants from the government group, despite it being the group that would primarily benefit from such action. Second, industry participants accord high importance to this option, with it being the second most significant choice for this group. For companies directly engaged in mining, this control mechanism directly impacts their operations. In the context of using extractive technologies to address environmental challenges, both government and industry participants place significant value on this approach, in contrast to NGO participants, who scarcely prioritize it (Option E, Figure 9.3).

In addition to this package of measures associated with government investment, the second most favored tool is the promotion of multi-stakeholder cooperation to address the challenges posed (Figure 9.1). Participants based in countries rich in lithium resources attribute greater importance to this instrument (Option B, Figure 9.2). When examining the data segmented by membership groups, a broad dispersion becomes apparent. Participants from the government and industry groups prioritize multi-stakeholder cooperation mechanisms while those in the NGO group gave a very low rating. In fact, this option appears second to last in terms of the ranking of instruments by NGO participants (Option B, Figure 9.3). NGO participants, on the other hand, differ from the rest of the panel in prioritizing regulatory changes, both in lithium-rich and demanding countries, as the way of promoting higher standards and greater community participation in environmental control (Options D, F and G, Figure 9.3).

Environmental sustainability

Public policies or tools that should be implemented as a priority to address the environmental sustainability challenges according to the country of residence of the panelists (*)

Figure 9.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

References. Response options for figures 9.2. and 9.3

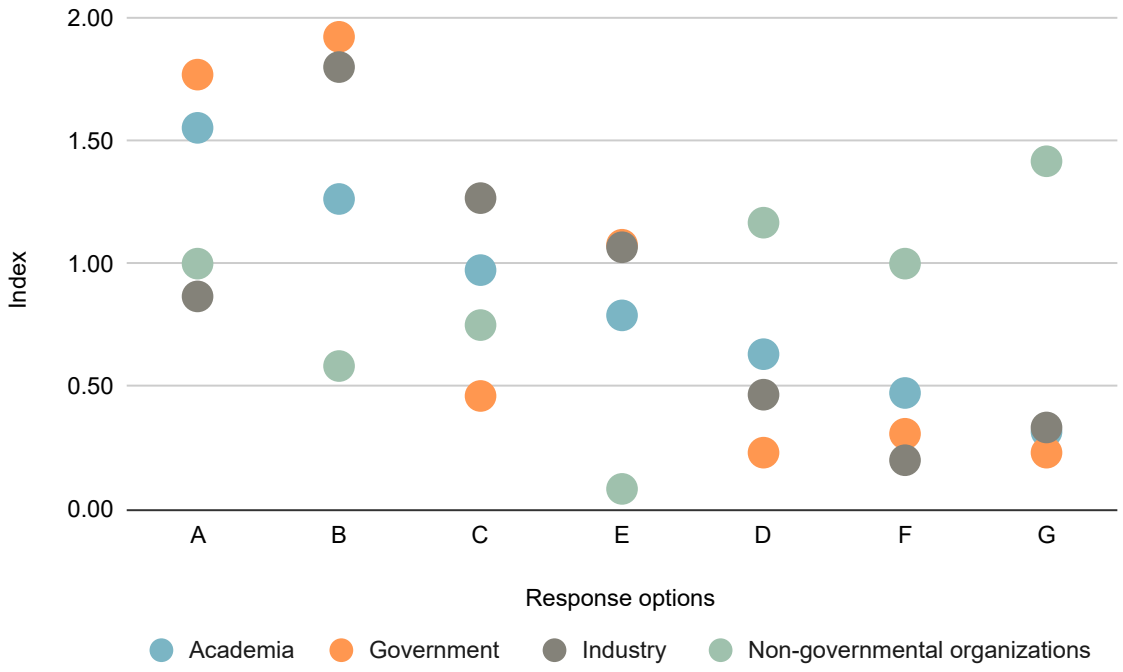
Table 7

Reference	Option
A	Increase state investment to create baselines, improve the generation and transparency of public environmental information, especially on water balance and biodiversity issues in each salt flat.
B	Promote multi-stakeholder cooperation (alliances between companies, government and research institutions, etc.) in mining countries to address the challenges of water balance and biodiversity in each salt flat.
C	Increase state investment to strengthen government monitoring capacity and ensure compliance with environmental standards.
D	Changes in legislation that ensure greater community participation in environmental monitoring and decision-making processes on environmental issues.
E	Increase investment in the development of new extraction technologies that substantially reduce impacts on the water balance and biodiversity.
F	Regulatory changes in mining countries requiring compliance with rigorous environmental standards, external audits and certifications.
G	Regulatory changes in lithium-importing countries requiring compliance with rigorous environmental standards, external audits and certifications.

Environmental sustainability

Public policies or tools that should be implemented as a priority to address the environmental sustainability challenges per membership group (*)

Figure 9.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

The third question pertaining to environmental sustainability queries the panel about the actors responsible for leading the selected initiatives (Figure 10.1). Participants give a high level of prioritization to the governments of countries that produce lithium, mainly at the national level (priority order 1). Subnational levels of government hold the fourth position in terms of priority. In a second group come into focus civil society actors: local communities and actors from the university system (priority order 2) and the scientific system (priority order 3). In third place are the mining companies (priority order 5).

Figure 10.1. Actors that should play a key role in promoting prioritized initiatives (*)

Considering the initiative you selected as most important, indicate which three actors should play a key role in promoting it, ranking them from 1 to 3 (1 being the most important).

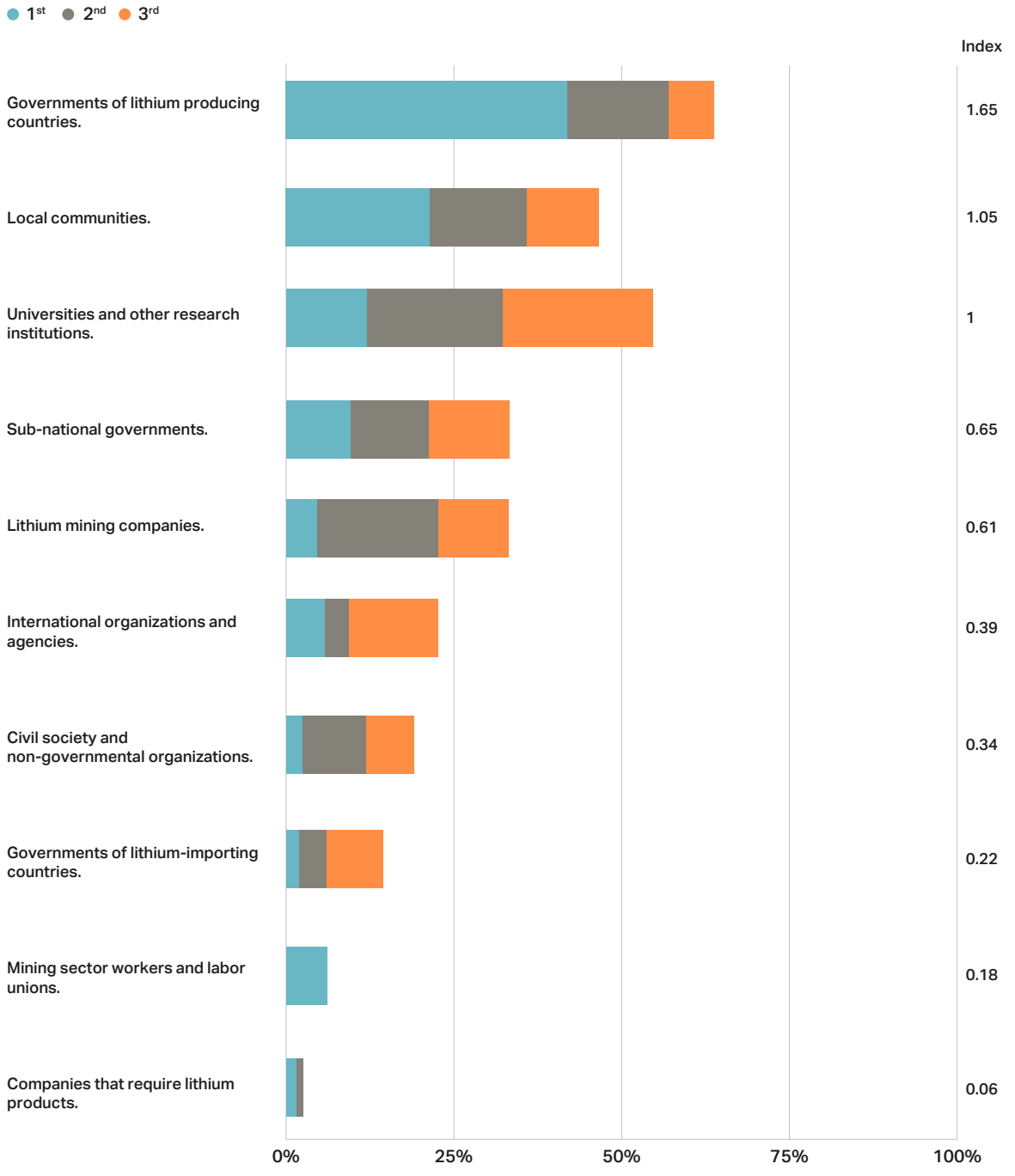


Figure 10.1

(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges. It was calculated assigning each response a value of 3 when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then calculated.

The data analyzed by the respondents' country of residence reveals no significant differences (Figure 10.2). The most relevant variations pertain to the role of mining companies, which obtain a higher ranking by lithium-rich countries (Option E, Figure 10.2), and to the role of civil society and NGOs and the governments of lithium-demanding countries, which received more votes from residents of these countries (Options B and I, Figure 10.2).

Responses categorized by the participants' stakeholder group exhibit a broader spectrum of opinions. Concerning the primary actors responsible for advancing the prioritized initiatives, government, industry, and NGO group members concur that this role should primarily fall upon the national governments of the lithium-producing countries (Option H, Figure 10.3). In contrast, participants from the academia, while acknowledging the significant role of national governments, believe that local communities play a pivotal role in driving these initiatives (Option A, Figure 10.3). Additionally, they rank the governments of resource-rich countries as the second most influential actors (Option H, Figure 10.3). This contrasts with the view of industry and government participants, who assign lower priority to communities. Regarding the role of universities and the actors of the scientific system, there is agreement among the participants that they are a relevant group to promote the prioritized initiatives, being chosen in second place by the government participants and in third place by those from industry, NGOs and academia (Option C, Figure 10.3).

Another noticeable point is the prevailing differences among the different groups with respect to the role of mining companies. Industry participants perceive them as the second most significant actors in advancing the prioritized initiatives, whereas NGO participants regard them as the least influential actors (Option E, Figure 10.3). A significant finding is the generally low priority assigned to international organizations and agencies (Option J, Figure 10.3). This result is striking since these organizations have the capacity and resources to enhance several of the prioritized initiatives, such as multi-stakeholder cooperation in mining countries, improving the generation of and access to public environmental information, or strengthening governmental capabilities.

Actors that should have a key role in promoting prioritized initiatives according to the country of residence of the panelists (*)

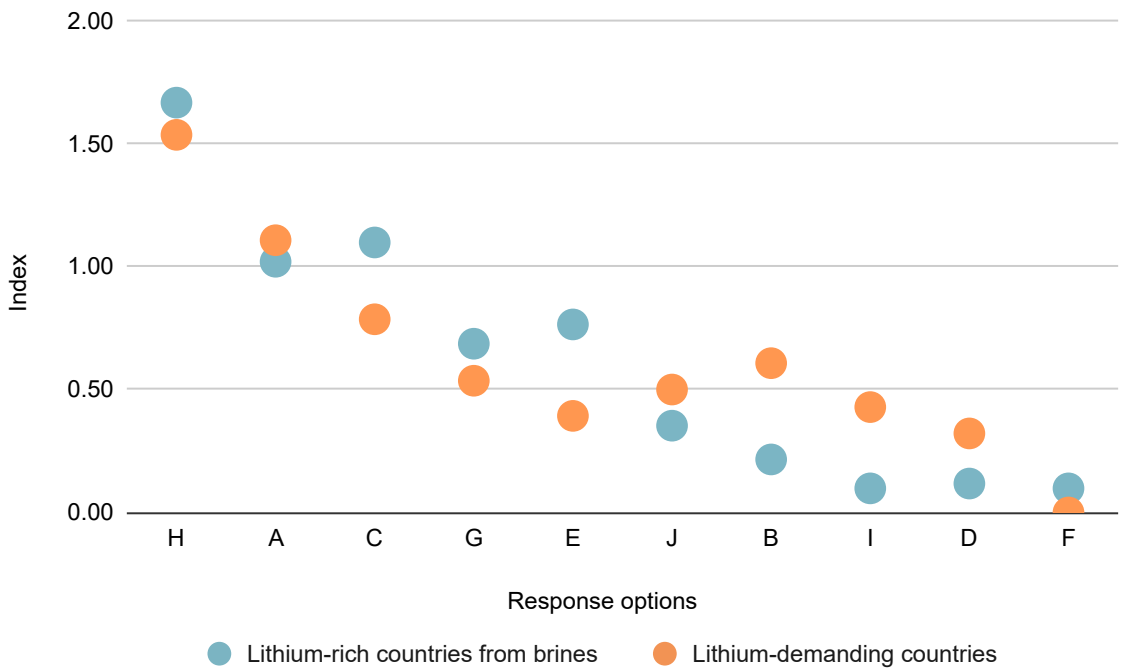


Figure 10.2

(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

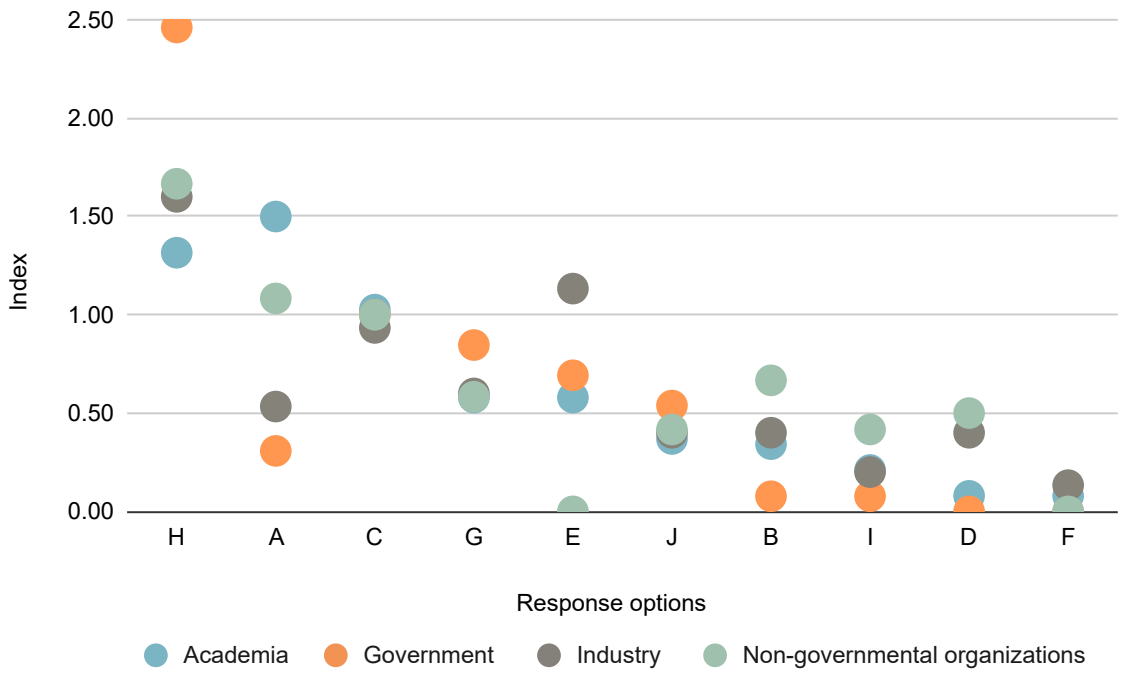
References. Response options for figures 10.2. and 10.3

Table 8

Reference	Option
A	Local communities.
B	Civil society and non-governmental organizations.
C	Universities and other research institutions.
D	Mining sector workers and unions.
E	Lithium mining companies.
F	Companies that require lithium products.
G	Subnational governments.
H	Governments of lithium-producing countries.
I	Governments of lithium-importing countries.
J	International organizations and agencies.

Actors that should play a key role in promoting prioritized initiatives per membership group (*)

Figure 10.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

Environmental sustainability. Workshop inputs to public policy initiatives and instruments

During the workshop sessions, participants highlighted several of the problems identified in the survey, characterizing them as challenges to environmental sustainability. These issues encompassed difficulties in accessing documentation during environmental impact assessment processes, the production of inadequate environmental impact reports, deficiencies in technical expertise within government agencies, and the lack of trust on the part of local communities in the scientists and officials responsible for environmental monitoring and oversight. Other relevant issues included the erosion of multi-stakeholder dialogue roundtables in the Chilean experience, the lack of information in non-technical language to facilitate the general public's understanding of technical matters, and related to this, the existing tensions between academic-scientific or technical knowledge and the knowledge of the local communities (indigenous communities, locals, etc.) in the territory.

An important issue not identified in the survey, but highlighted during the workshops, is the cumulative impact produced by the coexistence of projects extracting freshwater and brine from the same hydrological basin. This issue is inadequately addressed within environmental impact assessment systems, which typically focus on individual projects. As a result, there is a lack of clarity on how the environmental authority evaluates cumulative impacts and issues permits in such complex scenarios.

Box 1

Regarding the policy proposals identified in the survey, workshop participants did not delve into how to achieve greater state investment to improve the generation of environmental baselines or to strengthen government oversight capacity or regulatory changes. Most of the proposals focused on enhancing multi-stakeholder cooperation in mining countries to address the challenges related to water balance and biodiversity in each salt flat. The primary objective was to foster trust-building and mitigate tensions among the diverse array of stakeholders involved. The following provides a condensed overview of the exchange of experiences and proposals that emerged from the workshops on these matters:

Change the focus of participatory monitoring and work on the perception of the concept of risk

- Participatory environmental monitoring: In some Argentine provinces, participatory environmental monitoring is mandatory and can be considered an integral part of government oversight. Workshop discussions showed varying opinions on its effectiveness among industry stakeholders. While some asserted its success, others contended that it falls short due to local communities not being adequately trained to understand the parameters being measured. A suggestion was made to improve the way in which participants are trained. A participant from Europe pointed out that involving participants in the selection of the parameters to be monitored enhances learning and helps improve the trust building between parties.

- Citizen science is a research field in which the general public, regardless of their academic background, actively participates in the collective and open production of scientific knowledge. An example of citizen science can be found in bird monitoring, where observers can share their photographic and sound records in an open digital platform where collective monitoring of species distribution is carried out (see eBird project). In the context of mining, there is a potential application for citizen science within participatory environmental monitoring. This structured, systematic, and open approach would connect scientists,

government officials, company personnel, and local communities, legitimizing the data collected and promoting transparency. This approach could complement formal state environmental oversight activities, enhancing information transparency and building trust among stakeholders.

- Work from industry with NGOs and academics on how they perceive the risk of environmental impacts associated with lithium mining.

Changing the approach to protocols and how knowledge is built for impact assessment and environmental decision-making

Industry participants highlighted the "Towards Sustainable Mining" program as a voluntary initiative undertaken by mining companies that seek to enhance transparency and establish greater credibility in social and environmental performance of mining companies. It achieves this by implementing specific protocols for water and biodiversity management.

Other actors working with communities in the territories pointed out that the application of protocols by mining companies, even when scientifically rigorous, may not effectively build trust with local communities. To overcome mistrust, it is necessary to adjust the protocols to the territories where they work and to integrate local perspectives. As one participant stated, "it is not the same if you arrive at a result hand in hand with the community as if you arrive with a solution implemented from outside".

In turn, participants working with communities underscored the need to build a common language that transcends technical jargon and serves as a tool for fostering collaborative and egalitarian knowledge-sharing between technicians and community members, thus overcoming traditional hierarchies. This implies innovation in integrating various types of knowledge. In this regard, a novel interdisciplinary field, termed "socio-hydrology" or "socio-hydrogeology" was suggested. This concept involves hydrology experts, in addition to their usual responsibilities, engaging with local communities to facilitate mutual understanding and recognition of diverse knowledge types, contributing jointly to technical assessments while appreciating the different perspectives. As a result, decisions are reached as collaboratively as possible. This may lead stakeholders to change their opinion on whether and to what extent intensive brine pumping in a salt flat is contributing to the decrease in the flow of a river in the area.

Increased coordination and interaction among stakeholders

Workshop participants pointed out the importance of exploration and mining companies coordinating their relationship strategies, especially in Argentina, where there are many projects at different stages. In this context, it was noted that companies operating in the same area have separate and uncoordinated relationships with the same local communities.

Participants pointed out the need to deepen the joint work between companies and the state, for example, to agree on environmental baselines.

Source: elaborated by the authors based on participatory virtual workshops.

Social Sustainability

In the dimension of social sustainability, the panel highlights two major challenges that should be tackled as a priority (Figure 11.1). Firstly, there is the challenge of developing a strategy fostering the coexistence of lithium mining with other regional economic activities such as tourism or agriculture. Secondly, and directly linked to the previous challenge, the panel underscores the need to mitigate the adverse impacts of the mining activity on the social and cultural practices of local communities. This entails the essential respect for the rights of these communities and the absolute necessity of ensuring the effective implementation of free, prior, and informed consultation processes with indigenous peoples.

Main challenges for the social sustainability of lithium mining in salt flats (*)

Given this information, which of the following social sustainability challenges should be addressed as a priority? Please indicate the four most important, ranking them from 1 to 4 (1 being the most important).

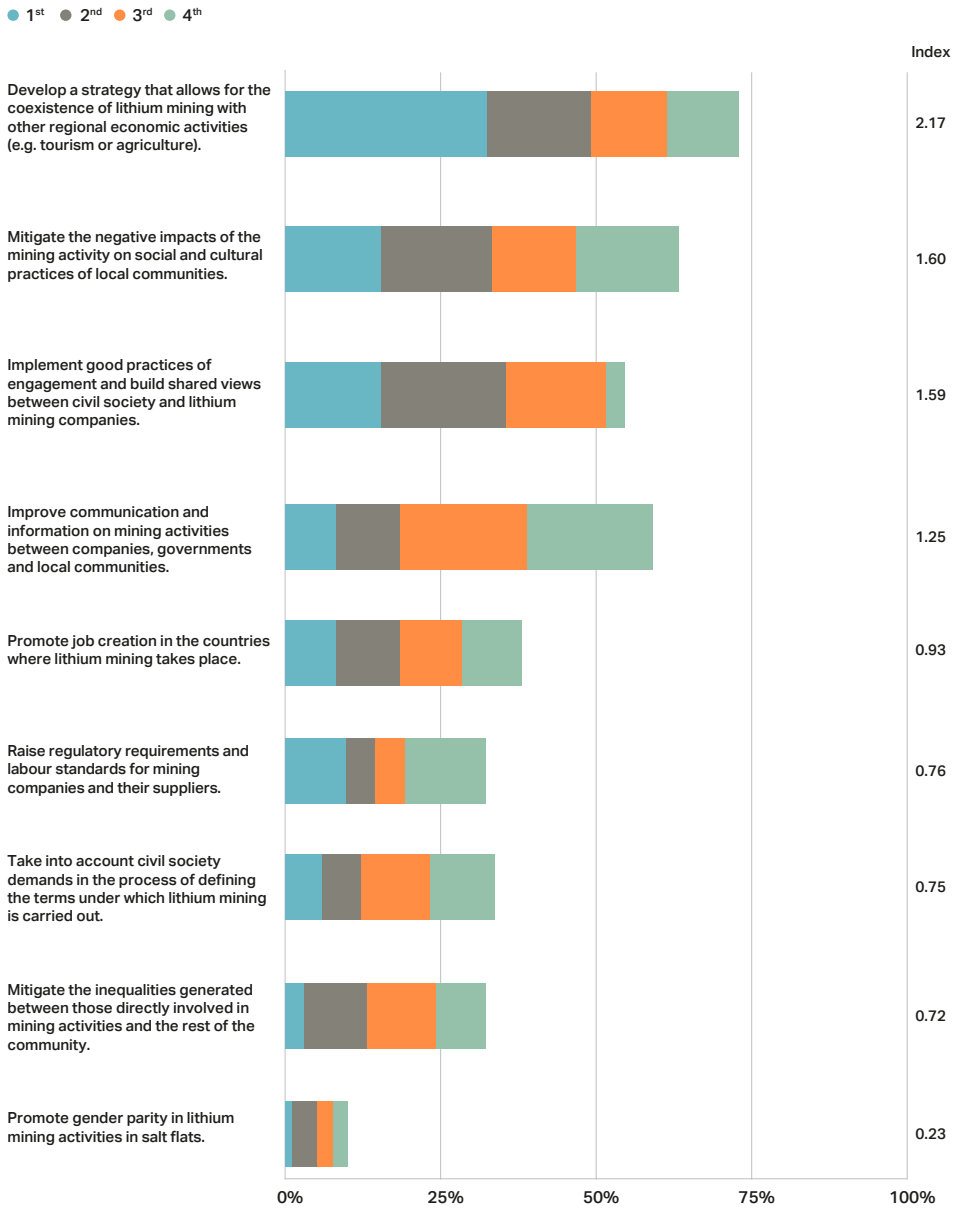


Figure 11.1

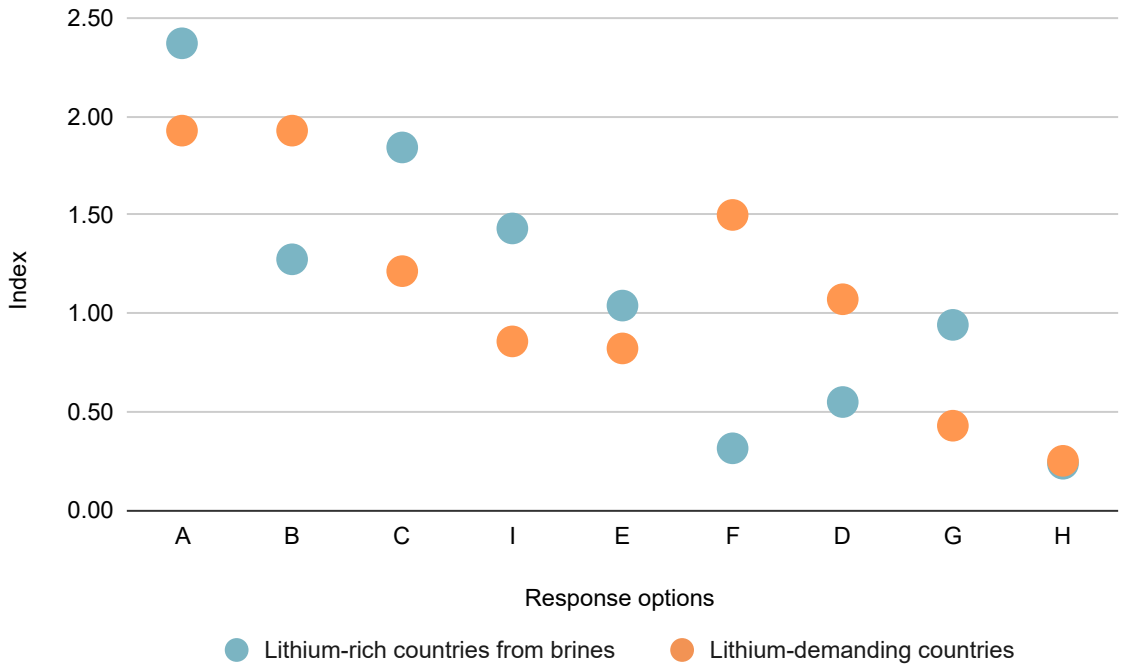
(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges. it was calculated assigning each response a value of 4 when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then calculated.

Addressing the highlighted challenges, participants from lithium-rich countries assign greater priority to the development of a strategy favoring the coexistence of mining with other economic activities, fostering a shared vision between civil society and mining companies, and improving information and communication on mining activities (Options A, C and I, Figure 11.2.). Respondents from lithium demanding countries, while supporting the first option, prioritize the challenge of mitigating societal and cultural impacts on local communities and advocate more stringent regulatory requirements on companies (Option B and F, Figure 11.2).

While a coexistence strategy is considered a priority for all four stakeholder groups, industry participants rank it as the highest priority (Option A, Figure 11.3). Conversely, when it comes to the impact on social and cultural practices, there is a noticeable divergence in the responses from different stakeholder groups: NGO participants prioritize it as the most significant social sustainability challenge, even surpassing the need for developing a coexistence strategy. In contrast, industry and government participants assign lower priority to this challenge (Option B, Figure 11.3). The latter two groups emphasize the need to improve information and communication on mining activities and build mechanisms to foster relationships and shared perspectives between companies and civil society (Option I and C, Figure 11.3). In contrast, NGO participants prioritize integrating civil society demands in the definition of the terms under which lithium mining is carried out and to implement more stringent regulatory requirements on companies (Options D and F, Figure 11.3.).

Main challenges for the social sustainability of lithium mining in salt flats according to the country of residence of the panelists (*)

Figure 11.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

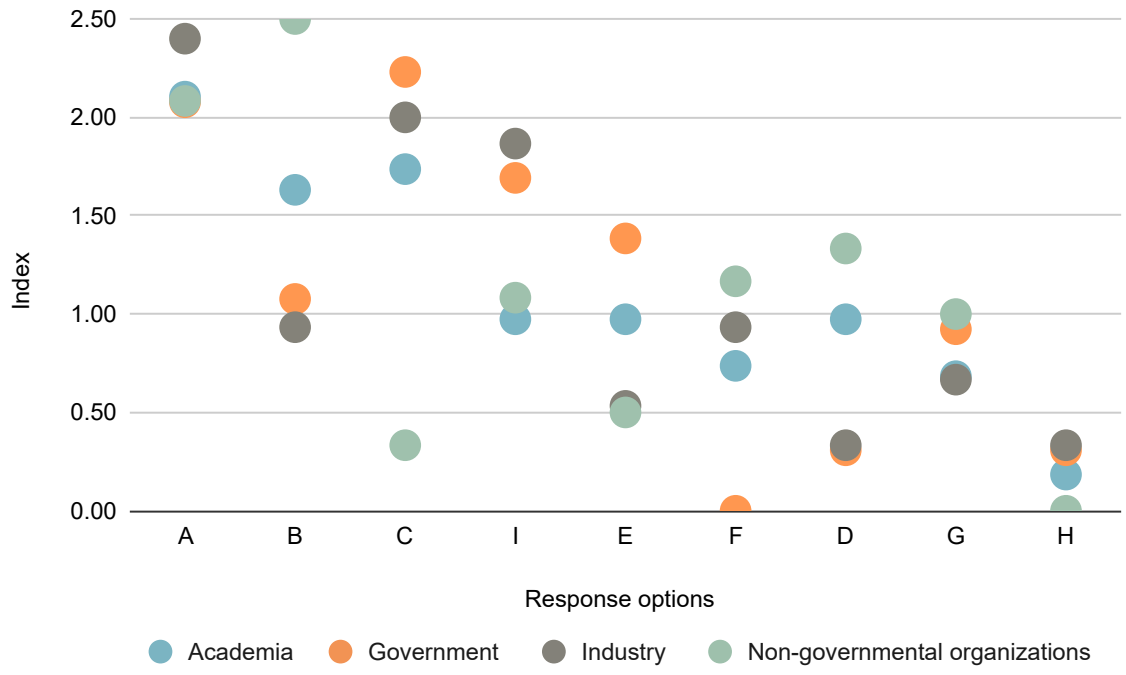
References. Response options for figures 11.2. and 11.3

Table 9

Reference	Option
A	Develop a strategy that allows for the coexistence of lithium mining with other regional economic activities (e.g., tourism or agriculture).
B	Mitigate the negative impacts of mining activity on the social and cultural practices of local communities.
C	Implement good practices of engagement and build shared views between civil society and lithium mining companies.
D	Incorporate the demands of civil society in the definition of the terms under which lithium mining is carried out.
E	Promote job creation in the countries where lithium mining takes place.
F	Raise regulatory requirements and labor standards for mining companies and their suppliers.
G	Mitigate the inequalities generated between those directly involved in the mining activity and the rest of the community.
H	Promote gender parity in lithium mining activities in salt flats.
I	Improve communication and information on mining activities between companies, governments and local communities.

Main challenges for the social sustainability of lithium mining in salt flats per membership group (*)

Figure 11.3



(*) Methodological note. The index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

Social sustainability

Overall, the public policy initiatives selected by the panel to address the social sustainability issues of lithium mining in salt flats align with the prioritized challenges (Figure 12.1). Thus, the top-ranked tool aims at developing strategic planning and land use planning that facilitate the coexistence of lithium mining with other economic activities. Subsequently, the focus is on the implementation of participatory mechanisms, linked to the challenge of integrating community demands . In this case, the panel highlights two key instruments: the development of consultation mechanisms that consider the perspectives of different stakeholders and are sensitive to cultural diversity (priority order 2), and the introduction of legislative changes to compel companies to incorporate the demands of civil society (priority order 3).

Public policies or tools that should be implemented as a priority to address the social sustainability challenges (*)

Which of the following public policy initiatives or tools should be implemented as a priority to address these social sustainability challenges? Please indicate the four that you consider most important, ranking them from 1 to 4 (1 being the most important).

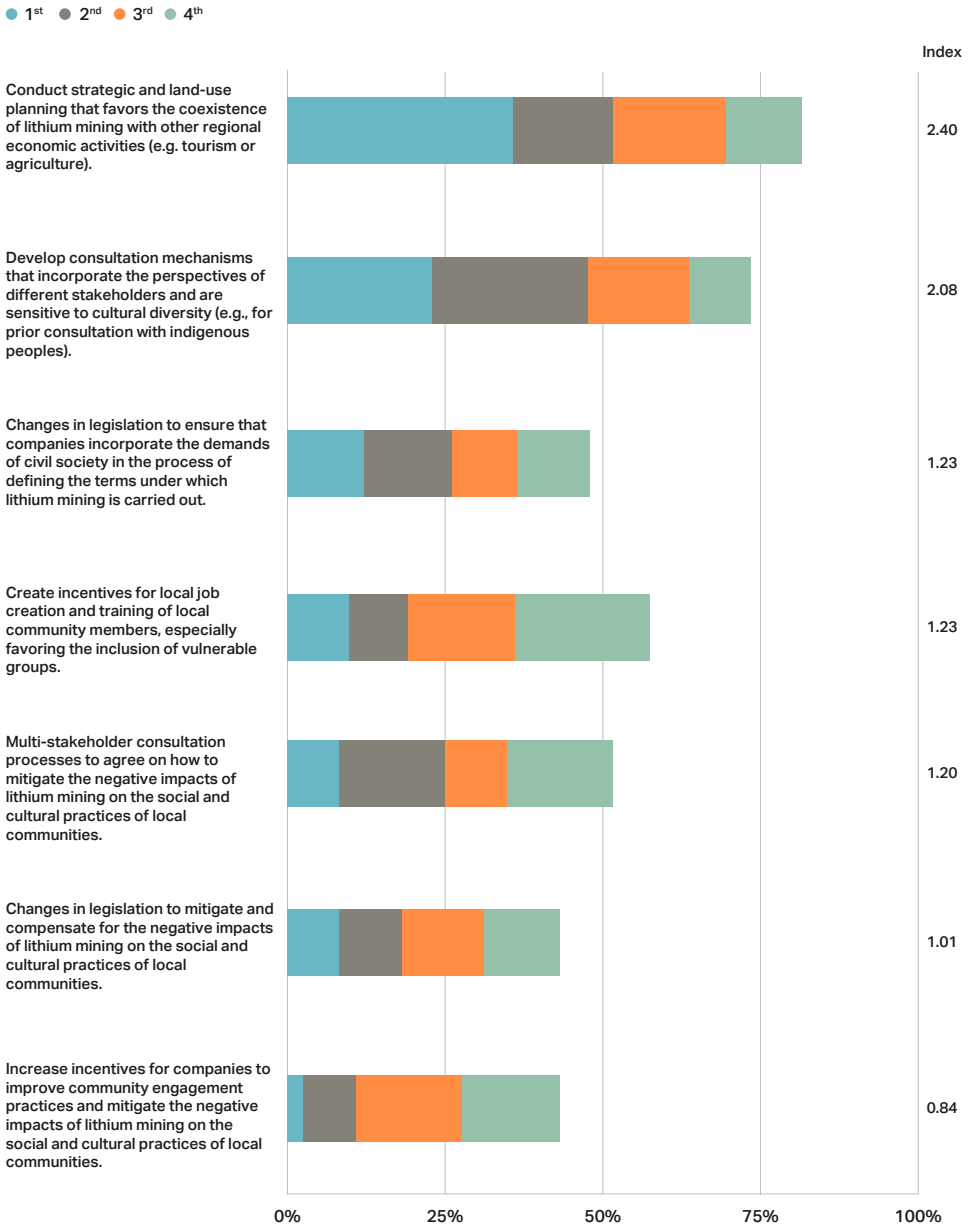


Figure 12.1

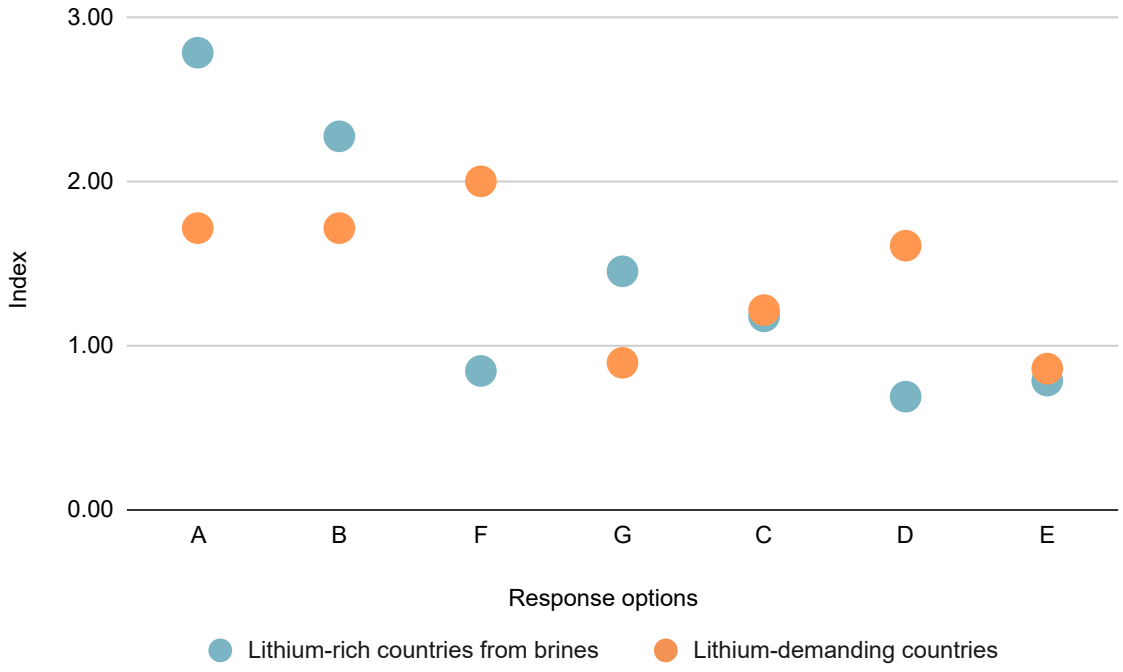
(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning each response a value of 4 when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained.

Significant disparities emerge in the preferences of participants from resource-rich countries and those from lithium-demanding nations regarding these three policy instruments. The former group places higher priority on instruments promoting coexistence of mining and regional economic activities, as well as the development of consultation mechanisms (Options A and B, Figure 12.2). In contrast, legislative changes have a low priority for this group (Option F, Figure 12.2). On the other hand, among respondents residing in lithium-demanding countries, the introduction of legislative changes to accommodate the demands of civil society is the most favored option (Option F, Figure 12.2). Policy tools aimed at developing a coexistence strategy and the development of consultation mechanisms, although important, are slightly less prioritized (Options B and A, Figure 12.2).

Analyzing the data by stakeholder group reveals disparities in policy initiatives. Regarding the two most prioritized by the panel, government and industry participants emphasize the necessity of a strategy favoring the coexistence of lithium mining with other economic activities. This position contrasts with that of NGO participants (Option A, Figure 12.3). Conversely, the initiative focused on the development of consultation mechanisms takes precedence among NGO and government participants, surpassing its prioritization by industry representatives (Option B, Figure 12.3). The option of introducing legislative changes to ensure companies accommodate the demands of civil society exhibits the most pronounced disparity: this option obtains high priority among NGO representatives but not among government and industry participants (Option F, Figure 12.3). A similar situation occurs with changes in legislation to mitigate for the negative impacts on social and cultural practices of communities: it is an option highly preferred by NGOs but less so by other stakeholders (Option D, Figure 12.3).

Public policies or tools that should be implemented as a priority to address the social sustainability challenges, according to the country of residence of the panelists (*)

Figure 12.2



(*) Methodological note. The index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

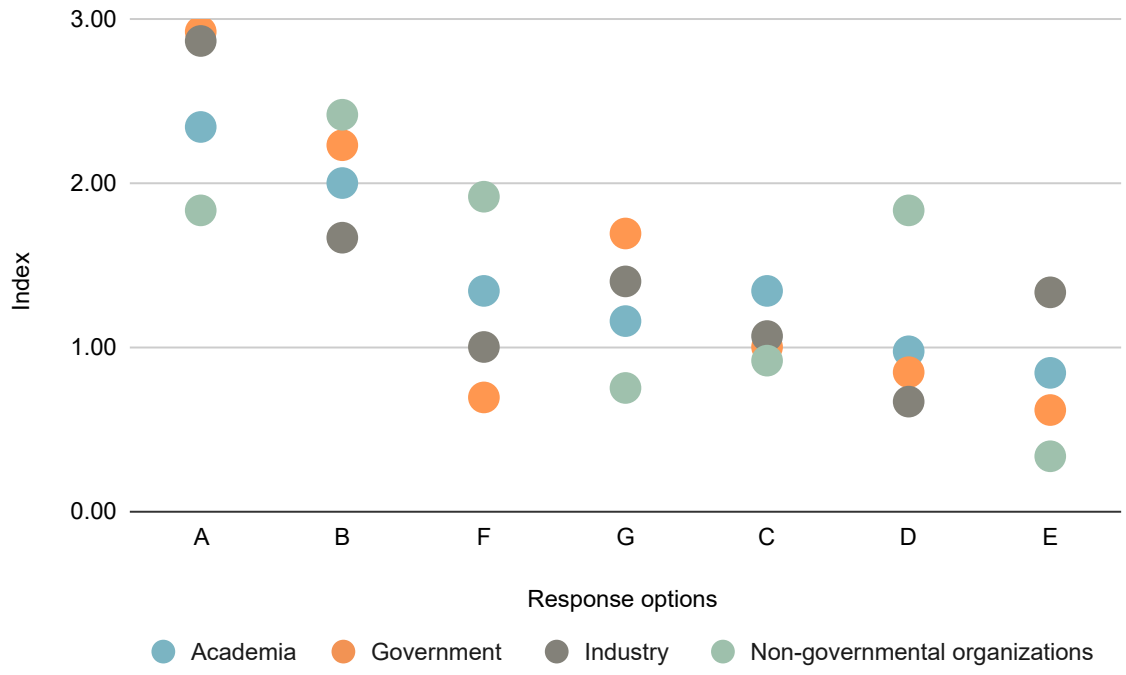
References. Response options for figures 12.2. and 12.3

Table 10

References	Option
A	Conduct strategic and land use planning that favors the coexistence of lithium mining with other regional economic activities (e.g., tourism or agriculture).
B	Develop consultation mechanisms that incorporate the perspectives of the different stakeholders and are sensitive to cultural diversity (e.g., for prior consultation with indigenous peoples).
C	Multi-stakeholder consultation processes to agree on how to mitigate the negative impacts of lithium mining on the social and cultural practices of local communities.
D	Changes in legislation to mitigate and compensate for the negative impacts of lithium mining on the social and cultural practices of local communities.
E	Increase incentives for companies to improve community relations practices and mitigate the negative impacts of lithium mining on the social and cultural practices of local communities.
F	Changes in legislation to ensure that companies incorporate the demands of civil society in the process of defining the terms under which lithium mining is carried out.
G	Create incentives for local job creation and training of local community members, especially favoring the inclusion of vulnerable groups.

Public policies or tools that should be implemented as a priority to address the social sustainability challenges per membership group (*)

Figure 12.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges. It was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

Finally, when considering the actors that should lead the prioritized initiatives, the panel places local communities in the top position. In second order, the governments of the lithium-rich countries are mentioned at different levels (national level in order of priority 2, and subnational level in order of priority 3). Subsequently, universities, the scientific community, civil society actors and NGOs are mentioned. In line with the other sustainability dimensions analyzed in this survey, companies, governments of lithium-demanding countries and international organizations and agencies play, according to the panel, a secondary role in this area (Figure 13.1).

Actors that should play a key role in promoting prioritized initiatives (*)

Considering the initiative you selected as most important, select the three actors that should play a key role in promoting it, ranking them from 1 to 3 (1 being the most important).

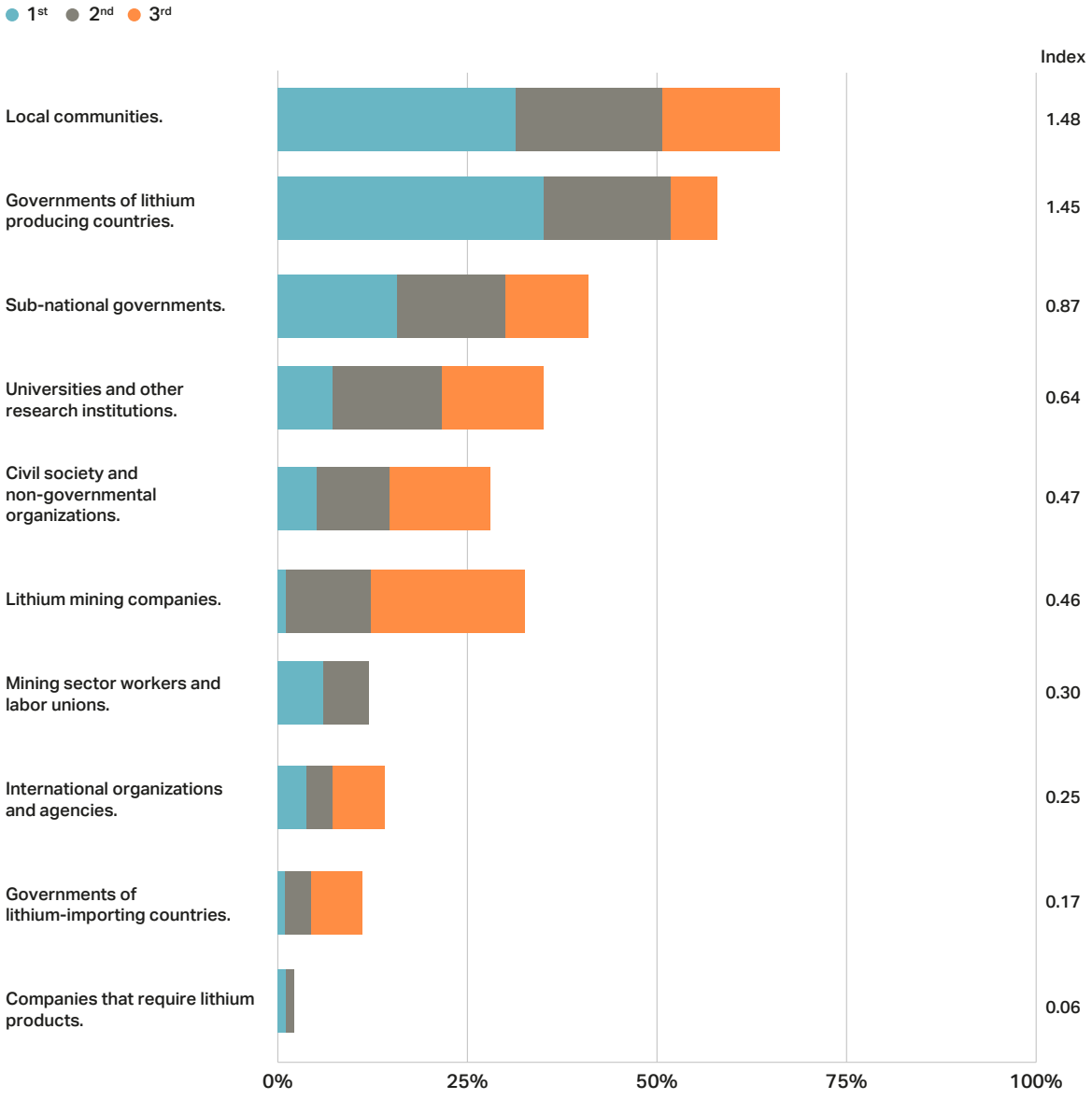


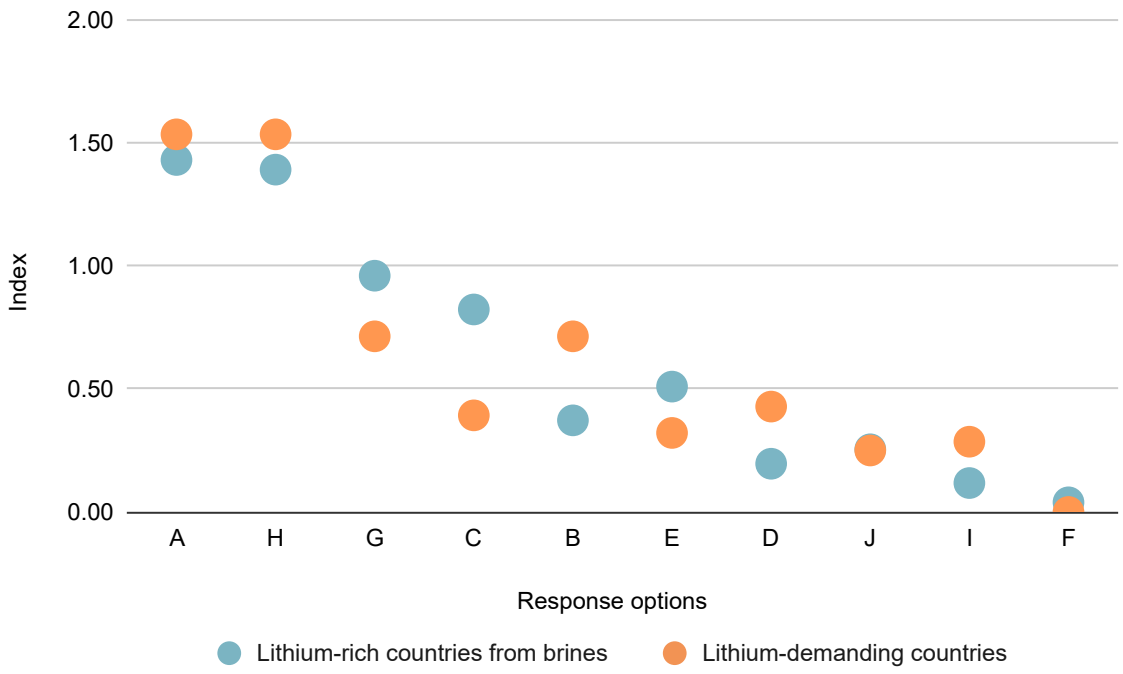
Figure 13.1

(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning the response a value of 3 when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained.

When analyzing differences by participants' country of residence, no significant divergences are observed. The most notable exception concerns the role of universities, which is given higher priority by respondents from lithium-rich countries (Option C, Figure 13.2). Conversely, civil society and NGOs are more favored by representatives from lithium-demanding countries (Option B, Figure 13.2).

Figure 13.2

Actors that should play a key role in promoting prioritized initiatives according to the country of residence of the panelists (*)



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

References. Response options for figures 13.2. and 13.3

Table 11

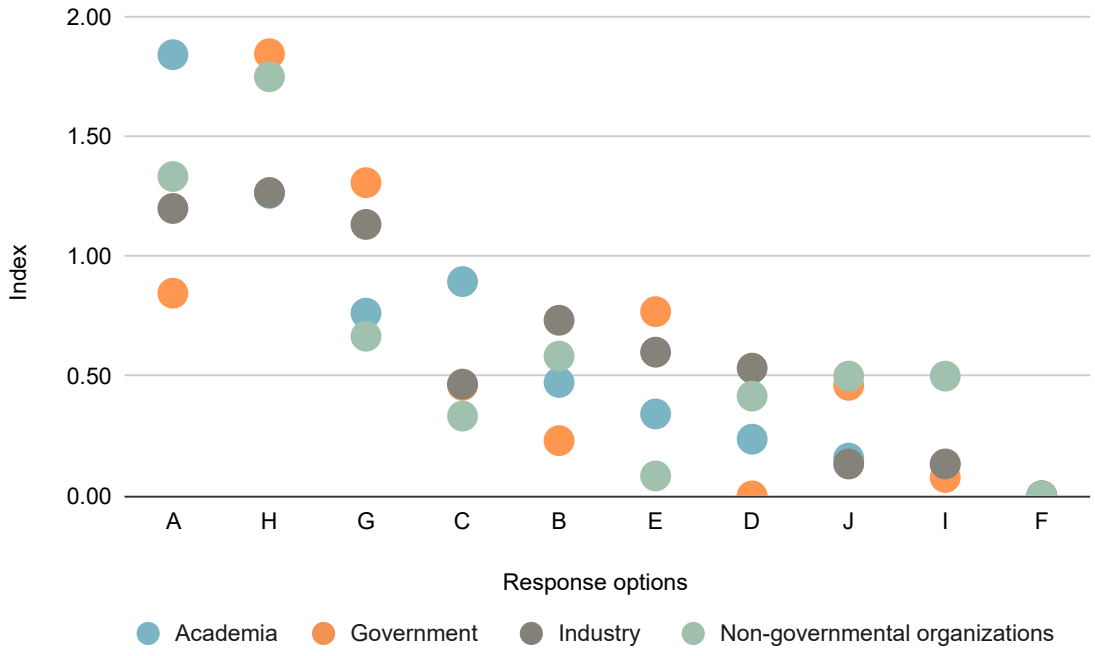
Referencia	Opción
A	Local communities.
B	Civil society and non-governmental organizations.
C	Universities and other research institutions.
D	Mining sector workers and labour unions.
E	Lithium mining companies.
F	Companies that require lithium products.
G	Sub-national governments.
H	Governments of lithium producing countries.

I	Government of lithium-importing countries.
J	International organizations and agencies.

Regarding the differences among stakeholder groups, an important divergence is observed, with academia representatives particularly prone to prioritizing local communities. In contrast, government participants do not consider communities among the most prominent actors (Option A, Figure 13.3). Regarding the choices of industry, government and NGOs, there is significant convergence and relative consistency in prioritizing the national and subnational governments of lithium-producing countries and local communities (Options H, G and A, Figure 13.3).

Figure 13.3. Actors that should play a key role in promoting prioritized initiatives per membership group (*)

Figure 13.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

Participation of the communities in salt flats regions in the economic benefits of lithium mining. Workshop contribution to public policy initiatives and tools

During the workshops, participants emphasized the vital significance of guaranteeing that the economic gains associated with lithium mining, particularly those from tax revenues, directly benefit the local communities near mining projects, ultimately enhancing their quality of life. Furthermore, several participants highlighted challenges related to consultation processes, such as reaching a consensus on how to enhance the participation of local communities in the economic benefits of lithium mining. Among these challenges, it was highlighted that some consultations are merely regarded as a formal requirement (a "check-list"). The state does not guarantee civil society consultation processes organized by companies, and some local communities are not involved in the consultations.

In relation to the proposals gathered in the survey, participants' interventions on how to improve the participation of local communities in the economic benefits linked to lithium mining focused on regulatory issues, training and community relations.

Participatory and multi-stakeholder consultation processes to agree on how to improve the participation of local communities in the economic benefits of lithium mining

Box 2

Participatory and multi-stakeholder consultation processes were validated as valuable tools with potential to facilitate discussions and agreements on how to improve the participation of local communities in the economic benefits of lithium mining. However, workshop participants identified several shortcomings inherent to such processes that need to be addressed. These shortcomings include:

- Sometimes, it was observed that small local communities lack a comprehensive understanding of their rights and engage in negotiations with mining companies under uneven conditions, thereby diminishing their prospects of securing favorable agreements. In this regard, there was an emphasis on the necessity to enhance their capacities, including:
    - NGOs and universities can play a crucial role in educating small local communities on their rights, leadership, management, and negotiation skills.
    - Having a credible third party is essential for facilitating a robust relationship between local communities and mining companies. If the state does not participate as a guarantor, the process may not be effective.
- It is necessary to conduct processes that encompass all residents without marginalizing any group, as such marginalization can erode legitimacy and foster divisions within communities.
- New business models must be explored that go beyond immediate economic gains. Early planning, in collaboration with local communities, is needed to envision post-mining stage uses for the mining site.

Social sustainability

Strengthening of municipal capabilities and changes in the regulatory framework to ensure greater participation of local communities in the economic benefits of lithium mining

- In the case of Argentina, a federal country, it was noted that the current tax structure predominantly directs tax benefits to the national government providing provinces with a smaller share. Of that small share, only a fraction is allocated to municipalities and local communities. A potential reform entails revising this structure to enhance local-level participation.

- However, concerning the preceding proposal, it was pointed out that another factor inhibiting local communities from receiving economic benefits is corruption and mismanagement of the tax resources allocated to municipalities. To address this issue, it was stressed that there's a need to introduce regulatory changes aimed at preventing the resources generated by mining activity from being dissipated at the local level, either through immediate spending or other forms of expenditure that do not yield a lasting positive impact on municipalities.

- Also, it was highlighted the need to strengthen the capabilities of local governments, such as municipalities and districts, to prevent the mismanagement of funds from new projects. This was deemed to be particularly pertinent for municipalities that do not have large-scale mining projects in operation and that have little preparation and capacities to plan how they will invest the cash flows generated by future projects.

- Another proposal was to evaluate the introduction of changes in the business model by potentially including local communities as shareholders in the projects alongside provincial companies (as in the case of Argentina).

Source: elaborated by the authors based on virtual workshops.

Economic sustainability

Economic Sustainability

In the area of economic sustainability, the panel highlights two priority challenges. First, the participation of local communities in the economic benefits derived from lithium extraction must be improved. Secondly, the link between lithium mining, the productive fabric and the scientific-technological system must be deepened to foster the creation of new productive and technological capabilities (Figure 14.1).

Regarding these two challenges, there are disparities in the responses between participants from lithium-rich countries and those from lithium-demanding nations. The latter group prioritizes the question of community participation in the economic benefits of mining compared to that of technology linkages (Options A and B, Figure 14.2). The relationship is reversed for the group of resource-rich countries. The contrast is even more pronounced when examining responses by participants' stakeholder group. Participants from NGOs and academia rated the issue of community participation as a priority, as opposed to those from industry and, above all, government, who give it a substantially lower value (Option A, Figure 14.3). The latter groups, namely industry and government, assign greater importance to aspects related to productive and technological linkages (Option B, Figure 14.3).

A second set of priority challenges concerns the need to enhance transparency and accessibility to economic information linked to lithium mining in salt flats, as well as to improve the capacity of the state to capture the economic rent from lithium. In this case, the discrepancies are relatively narrower when analyzing the respondents' countries of residence. In both cases, it was the lithium-demanding countries that assigned a higher value to these issues (Options G and C, Figure 14.2).

There are very significant differences among various stakeholder groups regarding transparency and access to information: NGO representatives prioritize this issue, while participants from academia, governments and, notably, industry, regard it as a lower priority (Option G, Figure 14.3). When considering the state capture of economic rent, the differences are less significant. Academia participants assign a higher priority to this topic, while at the opposite end of the spectrum, industry participants rate it lower (Option C, Figure 14.3). Finally, industry representatives assign the highest priority to "productive" aspects, including areas like human resources training, safety, and incentives for investment, as well as infrastructure development for mining activities (Options D, E and H, Figure 14.3).

Economic sustainability

Main challenges for the economic sustainability of lithium mining in salt flats (*)

Taking this information into account, which of the following economic sustainability challenges should be addressed as a priority? Please indicate the four most important ones, ranking them from 1 to 4 (1 being the most important).

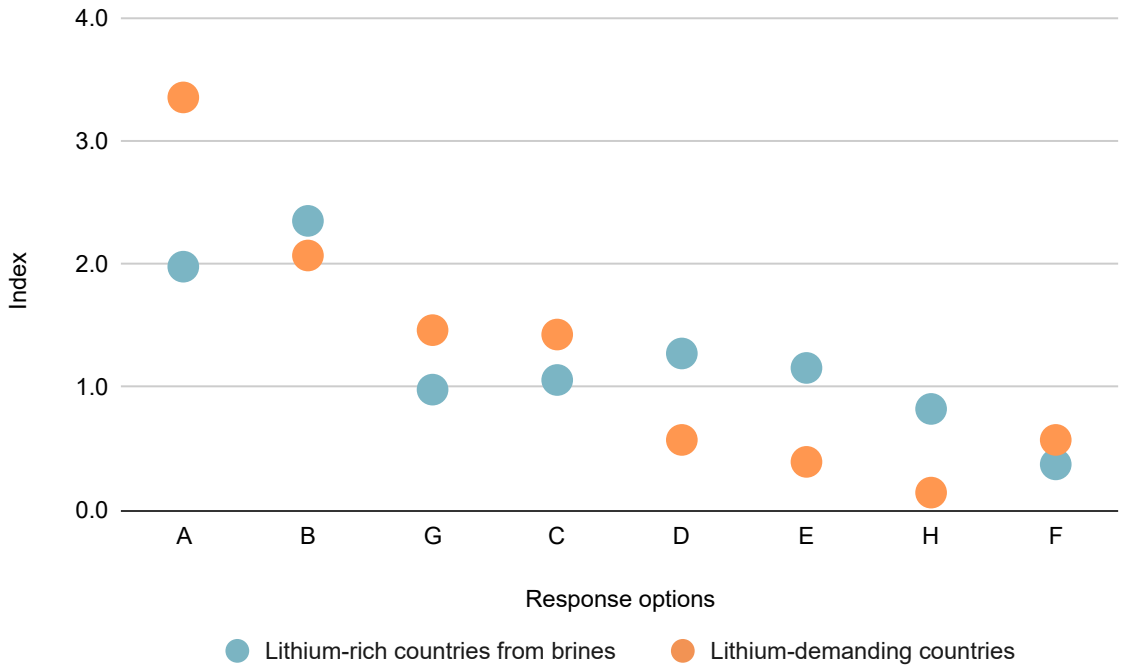
Figure 14.1

(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning each response a value of 4 when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained.

Economic sustainability

Main challenges for the economic sustainability of lithium mining in salt flats according to the country of residence of the panelists (*)

Figure 14.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

References. Response options for figures 14.2. and 14.3

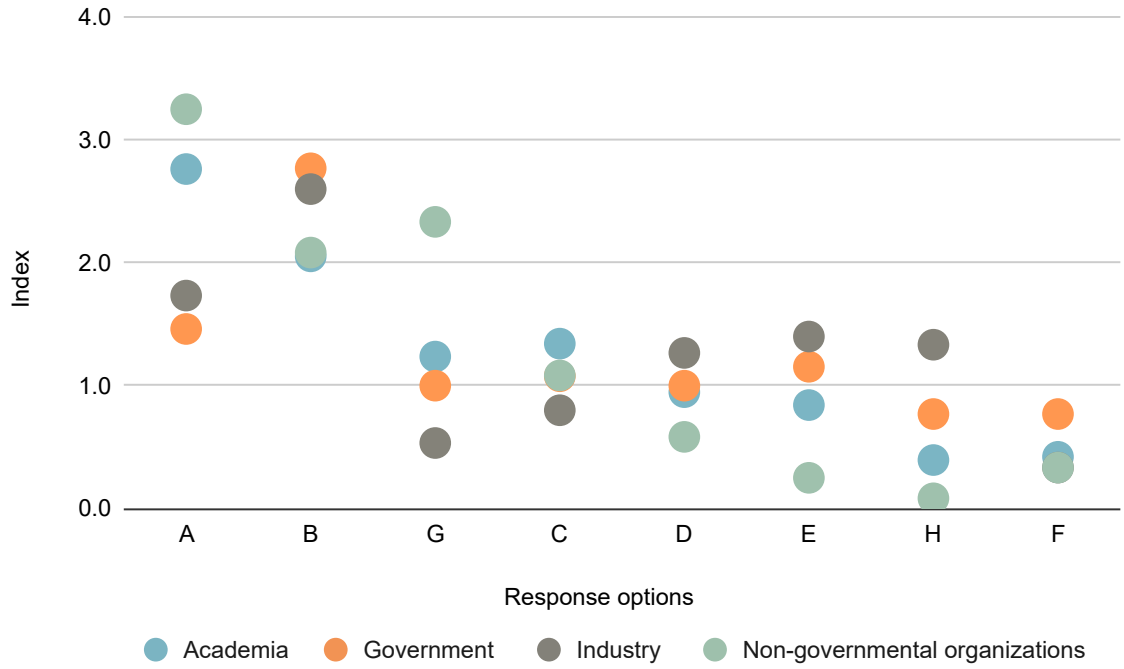
Table 12

Reference	Option
A	Improve the participation of local communities in the economic benefits of lithium mining.
B	Link lithium mining with the national economy and the scientific-technological system to build domestic capacities.
C	Improve the State's share of the economic rent from lithium mining.
D	Have human resources with the necessary skills to work in lithium mining.
E	Provide legal security and incentives for mining investment.
F	Produce lithium compounds at competitive costs and high quality standards.
G	Increase transparency and facilitate access to economic and fiscal information on mining activity.
H	Develop infrastructure for mining in salt flats (e.g., energy, transport).

Economic sustainability

Main challenges for the economic sustainability of lithium mining in salt flats per membership group (*)

Figure 14.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

In general terms, the policy proposals highlighted by the panel aligned with the challenges identified. To enhance community participation in the economic benefits of mining, the top-ranked proposal stresses the establishment of participatory processes and multi-stakeholder consultations to devise effective mechanisms. Also, the panel prioritized the proposal to enact regulatory reforms to bolster community participation (priority order 4). Regarding the challenge of deepening linkages between lithium mining, the productive structure and the scientific-technological system, the panel underscored the need to implement government policies that promote capability building in lithium-rich countries. This could include agreements to transfer technology or make access to lithium resources conditional on the development of local suppliers (Figure 15.1).

Economic sustainability

Public policies or tools that should be implemented as a priority to address the economic sustainability challenges (*)

Which of the following public policy initiatives or tools should be implemented as a priority to address these economic sustainability challenges? Please indicate the four that you consider most important, ranking them from 1 to 4 (1 being the most important).

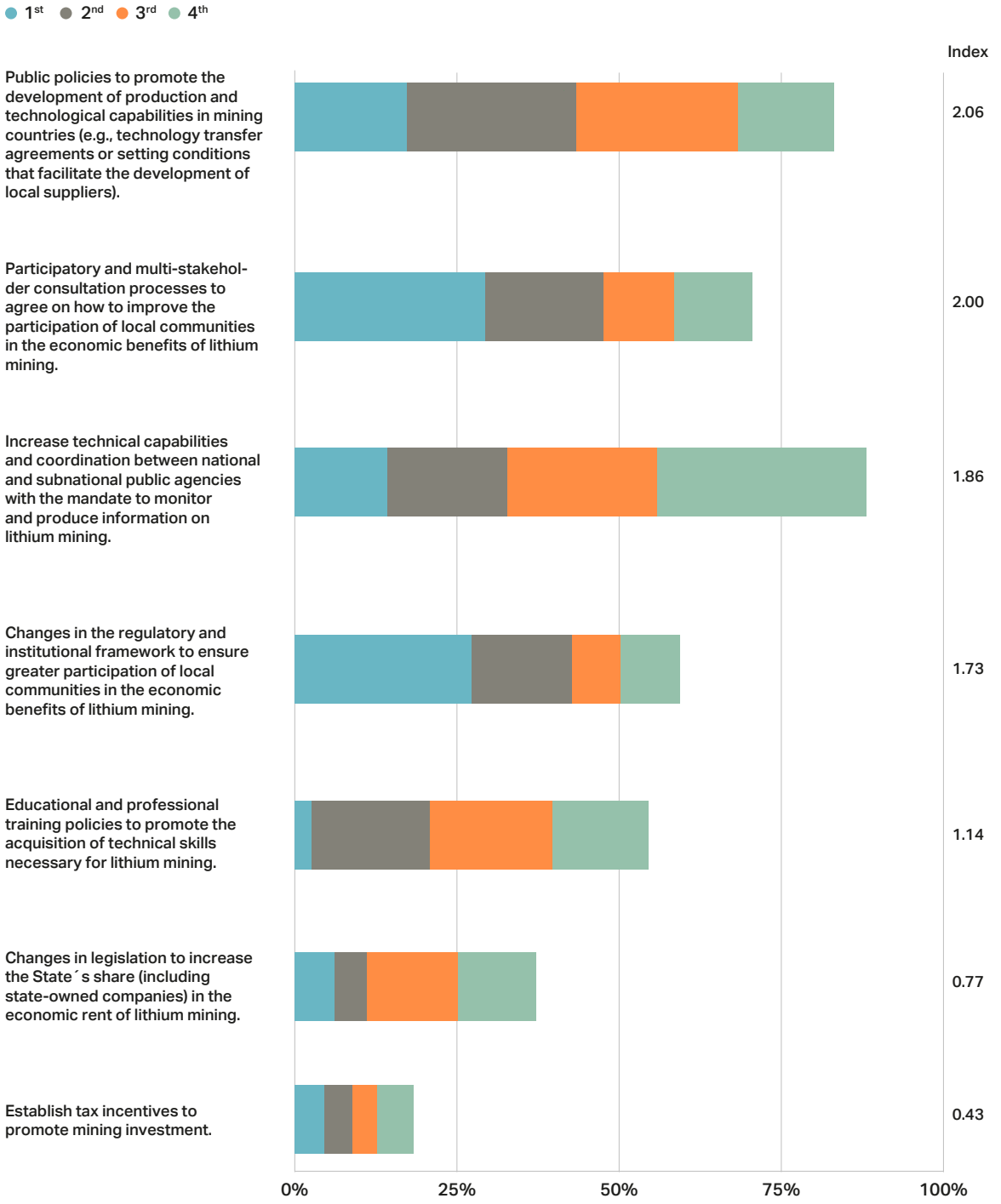


Figure 15.1

(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning each response a value of 4 when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained.

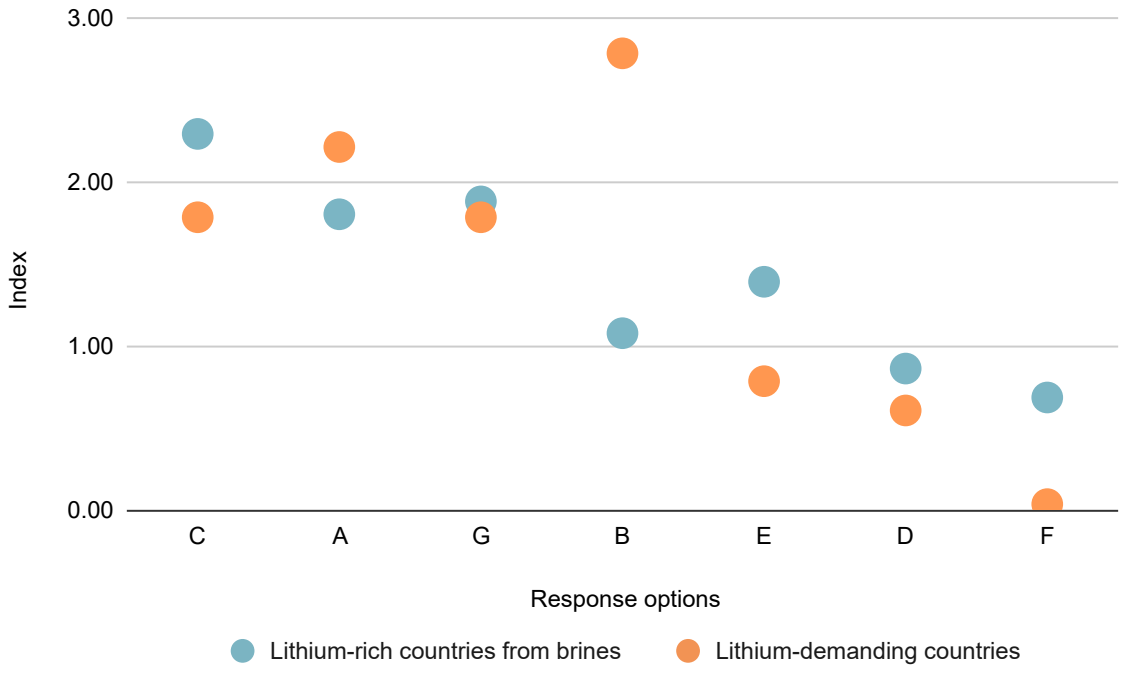
The positions of participants based in resource-rich countries and those in lithium-demanding countries differed significantly with respect to these policy instruments. The former group prioritizes productive and technological issues, while the latter underscores those linked to communities (Options C and A, Figure 15.2). The assessment of the policy proposals is aligned with the prioritization set by each group in regard to the challenges to economic sustainability faced by lithium mining. Particularly noteworthy is the high priority given by participants from lithium-demanding countries to legislative changes as a means to promote greater economic participation of communities (Option B, Figure 15.2).

The transparency of data based on participant membership groups reveals substantial disparities across nearly all options. Participants from the industry and government gave the highest rating to the proposal aimed at developing productive and technological capabilities (Option C, Figure 15.3). In the case of the tool oriented at developing multi-stakeholder participatory processes to improve the participation of communities in the economic benefits of mining, alignment is observed in the favorable assessments from participants in NGOs and the industry. However, government representatives provided a lower valuation for this proposal (Option A, Figure 15.3).

Regarding the third and fourth ranked initiatives assessed by the panel, significant differences can be found among participants (Figure 15.1). Capability building and coordination among government agencies represent the option highly favored by government participants but less so by those from the industry and NGOs (Option G, Figure 15.3). In contrast, making changes to the regulatory and institutional framework to ensure greater economic participation of local communities is the second most valued position by NGOs, in contrast to a comparatively lower level of importance attributed to it by government and, to a lesser degree, industry participants (Option B, Figure 15.3).

Figure 15.2

Public policies or tools that should be implemented as a priority to address the economic sustainability challenges, according to the country of residence of the panelists (*)



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

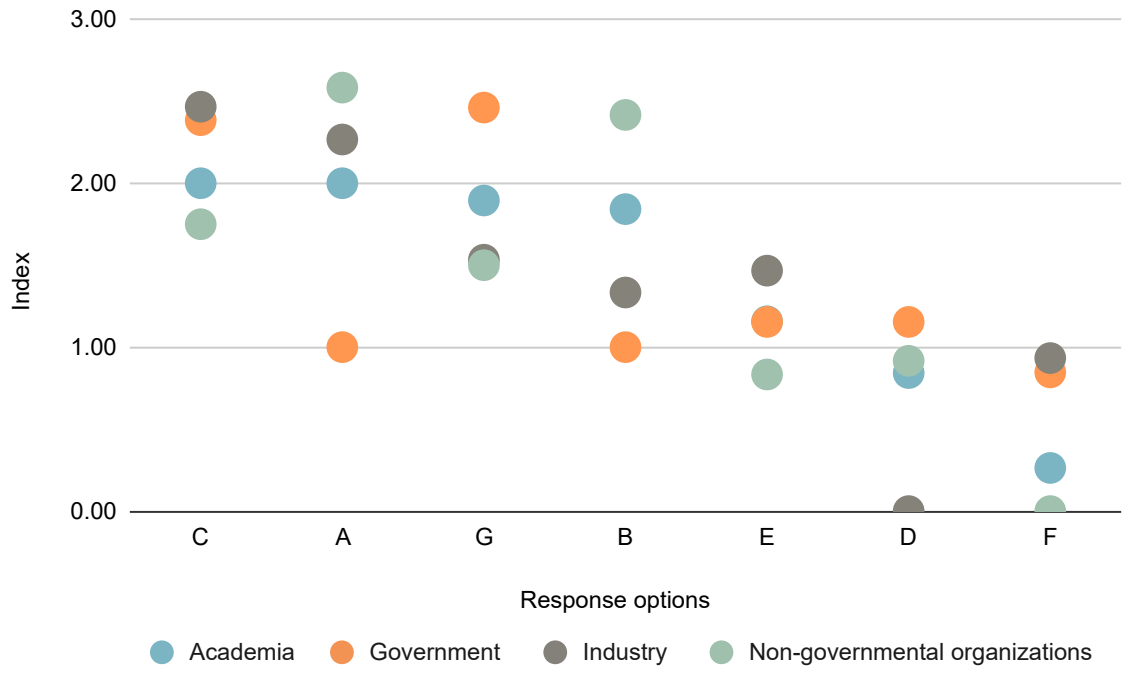
References. Response options for figures 15.2. and 15.3

Tabla 13

Reference	Option
A	Participatory and multi-stakeholder consultation processes to agree on how to improve the participation of local communities in the economic benefits of lithium mining.
B	Changes in the regulatory and institutional framework to ensure greater participation of local communities in the economic benefits of lithium mining.
C	Public policies to promote the development of production and technological capabilities in mining countries (e.g., technology transfer agreements or setting conditions that facilitate the development of local suppliers).
D	Changes in legislation to increase the State´s share (including state-owned companies) in the economic rent of lithium mining.
E	Educational and professional training policies to promote the acquisition of technical skills necessary for lithium mining.
F	Establish tax incentives to promote mining investment.
G	Increase technical capabilities and coordination between national and subnational public agencies with the mandate to monitor and produce information on lithium mining.

Public policies or tools that should be implemented as a priority to address the economic sustainability challenges per membership group (*)

Figure 15.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

Economic sustainability

Analogous to the sphere of environmental sustainability, according to the panel, the actors who should assume a leading role in the implementation of the selected initiatives are the governments of lithium-rich countries. At the forefront, national-level governments hold the highest priority, followed by subnational-level governments in fourth position (Figure 16.1). This is followed by civil society actors, including local communities (priority order 2) and academia (priority order 3). Mining companies rank fifth.

A secondary role was given to companies that demand lithium, international agencies and organizations, as well as to the governments of the countries that demand the mineral. The low position of these last two options is noteworthy, as these countries and organizations have resources that could potentially contribute to strengthening skills in producing nations. They could also help to overcome the disparity in resources between mining nations and those that demand the mineral, a major obstacle to achieving a just value chain.

Actors that should play a key role in promoting prioritized initiatives (*)

Considering the initiative you selected as most important, select the three actors that should play a key role in promoting it, ranking them from 1 to 3 (1 being the most important).

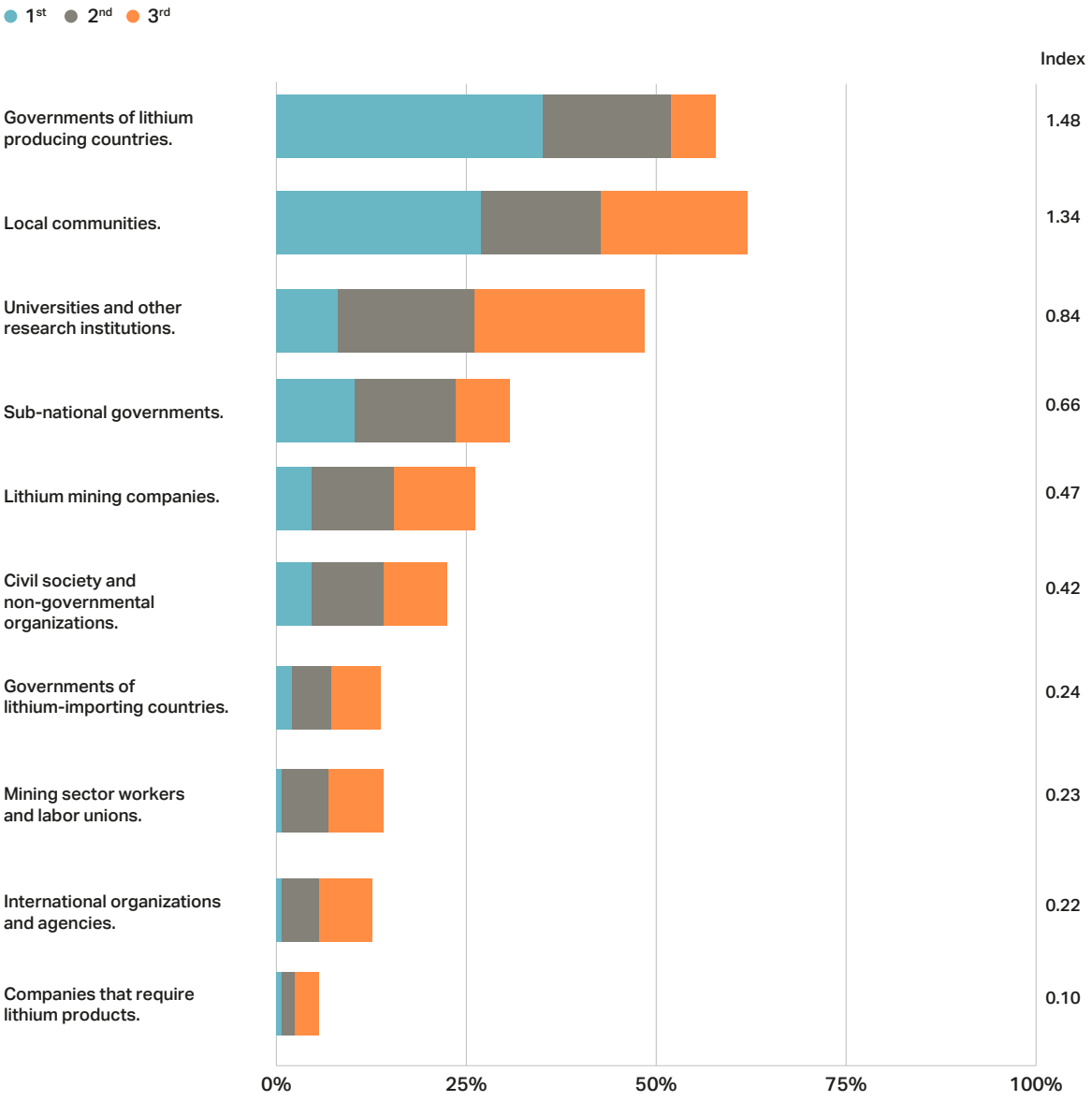


Figure 16.1

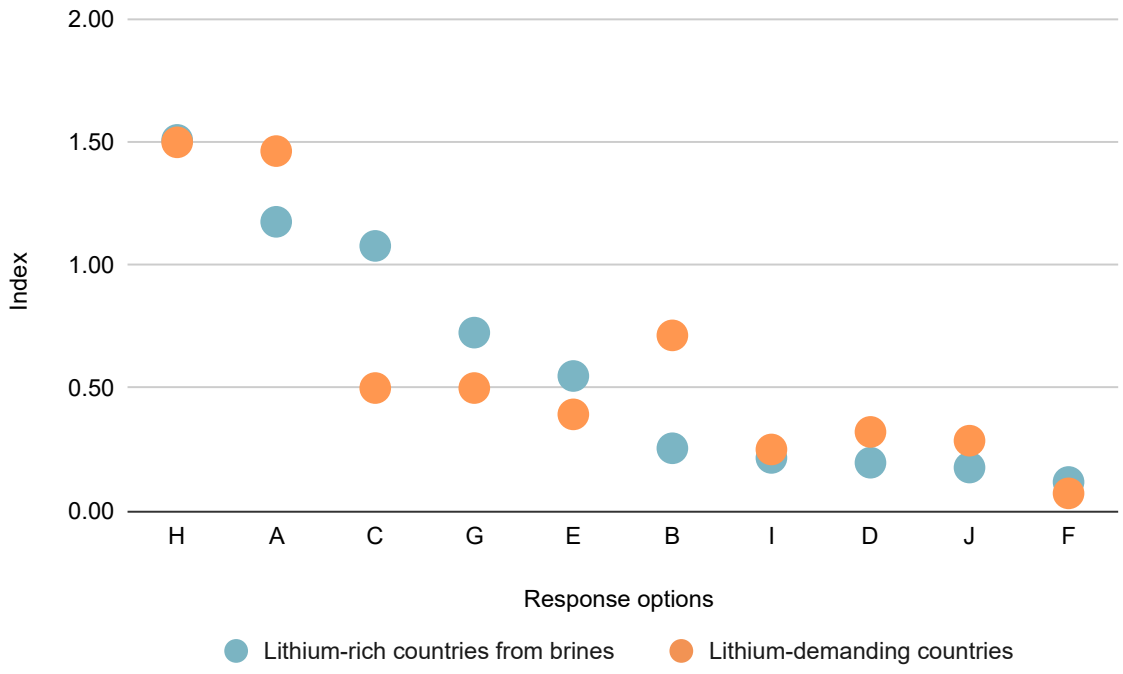
(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning each response a value of 3 when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained.

Participants from countries rich in lithium resources and those that demand the resource tend to have closely aligned positions on most options (Figure 16.2). The two most significant exceptions correspond, first, to the importance attributed to the actors of the scientific system, which is higher for panelists based in lithium-rich countries. The second difference pertains to the higher rank given to civil society and NGOs by residents in lithium-demanding countries (Options C and B, Figure 16.2).

Regarding the responses by stakeholder group, participants from governments and industry tend to position themselves at the center of efforts to address the challenges to economic sustainability (Option H and E respectively, Figure 16.3). Participants from all sectors assign a relevant role to the governments of resource-rich countries (Option H, Figure 16.3.). The most notable discrepancies are observed in the evaluation of the role of local communities, emphasized by participants from academia and NGOs, but not given as much weight by government or industry participants (Option A, Figure 16.3).

Figure 16.2

Actors that should play a key role in promoting priority initiatives according to the country of residence of the panelists (*)



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

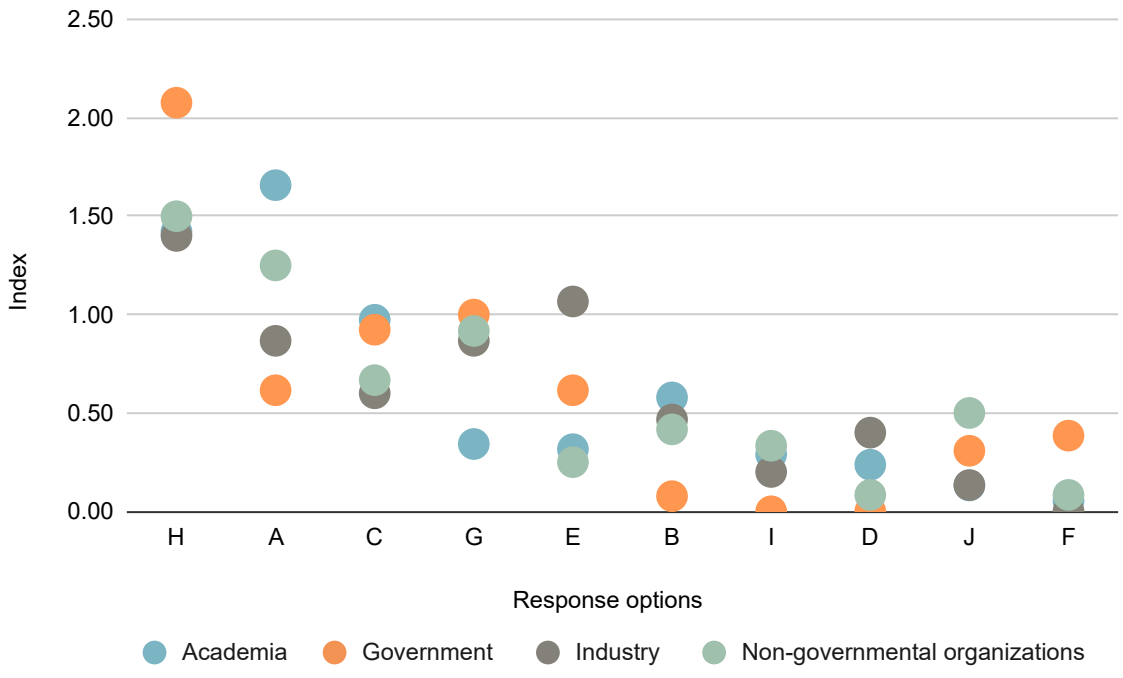
References. Response options for figures 16.2. and 16.3

Table 14

Reference	Option
A	Local communities.
B	Civil society and non-governmental organizations.
C	Universities and other research institutions.
D	Mining sector workers and unions.
E	Lithium mining companies.
F	Companies that require lithium products.
G	Sub-national governments.
H	Governments of lithium-producing countries.
I	Governments of lithium-importing countries.
J	International organizations and agencies.

Actors that should play a key role in promoting priority initiatives per membership group (*)

Figure 16.3



(*) Methodological note. The index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

Linkages with the productive structure and the national scientific-technological system. Workshops contributions to public policy initiatives and tools

The workshops provided a platform for representatives from Argentina, Bolivia, and Chile to share their insights on the challenges and achievements in establishing productive and technological linkages between lithium mining and science and technology domains. The discussion revolved around the challenge identified as a priority in the survey: how to develop productive and technological capabilities in mining countries. The following is a list of difficulties and possible initiatives to be addressed.

Cross-cutting policies throughout the value chain

The participants highlighted that the lack of continuity in policies to support the development of capacities and the link between lithium mining and the scientific-technological system is a significant problem. In this sense, they underscored the importance of having medium- and long-term public policies designed to promote an ecosystem focused on technological development. Such policies should establish a sustained and enduring connection between the scientific-technological domain and mining enterprises over time.

Box 3

Participants pointed out the disconnect that exists between the agendas, incentives and timeframes guiding the work of academics and researchers, on the one hand, and industry, on the other. In Argentina, the formality and timing of administrative processes within the scientific-technological system can impede cooperation and collaboration between researchers and lithium mining companies. The participants recognized the need to develop new formal and streamlined mechanisms to facilitate effective cooperation, thus promoting the development of solutions for productivity challenges and community engagement during the extraction phase. In Argentina, the example of the Center for Research in Advanced Materials and Energy Storage of Jujuy (CIDMEJu) was mentioned as an interesting case with potential to enhance cooperation with mining companies, but which is limited by some of the factors mentioned above.

In relation to the aforementioned issues, participants noted a lack of formal incentives and regulatory mandates for technological linkages in strategic matters, like the advancement of environmentally friendly technologies. They pointed to Chile's national lithium strategy, launched in 2023, which actively advocates the development of extraction technologies geared toward minimizing environmental impact, such as lithium direct extraction methods. Also in Chile, mention was made of the existence of formal mechanisms that allow the resources generated by lithium mining (royalties) to be channeled into the funding of research institutes, exemplified by the Institute of Clean Technologies.

Regarding Bolivia, it was noted that despite efforts to import technology and provide training for personnel, the experiences related to technology transfer and personnel development proved to be somewhat ineffective. The shortage of adequately trained human resources was a significant concern, and the potential for promoting specialized training abroad with the intention of having individuals return to the country was explored as a possible solution.

In the cases of Argentina and Bolivia, participants identified a lack of trust between actors (for example, academia) to link up with the industry as a stumbling block, and no proposals were put forward on how to overcome this barrier.

Policies for moving downstream in the value chain

During the workshop, noteworthy examples were discussed that were viewed as positive steps towards progressing further downstream in the value chain. In the case of Argentina, the experience of Y-TEC with the small-scale plant for manufacturing lithium-ion battery cells (UniLiB project, currently under development) was highlighted. A participant noted that the possibility of advancing in this development was based on the partnership with public universities,providing expertise, knowledge, physical facilities and budgetary support to initiate the project. He also considered it positive that the project is based on a concrete demand that allows for a guaranteed product placement. The objective of this project is not profitability, but the accomplishment of pilot projects and technological learning, with a focus on societal goals. For example, this may involve small-scale electrification projects within public transportation systems.

Likewise, in Y-TEC's experience, progress in the value chain led to the generation of parallel but related projects. Thus, the battery cell manufacturing plant project led to a pilot plant project for the production of active materials and a national electrolyte manufacturing project (both under development). According to one participant, the important thing about the experience is capability building: "even if the national electrolyte is not manufactured, what is important is knowledge acquisition and capacity building".

In Bolivia's case, it was pointed out that international cooperation with Japan made it possible to learn about the diversity of products related to lithium mining that could be marketed. This significantly contributed to progress on commercial and product quality issues, within the framework of the YLB pilot project to obtain cathode material.

In Chile's case, the importance of the Chilean Economic Development Agency (CORFO) in driving forward integration was emphasized. In 2022, CORFO initiated a call for investment project proposals aimed at advancing within the value chain, particularly projects that utilize lithium-based products as inputs at a preferential price and with a guaranteed supply until 2030. During 2023, it was announced that the Chinese company BYD won the call and will access a quota of lithium carbonate to build a cathode plant (active material for battery cells) in the Antofagasta Region (Chile).

Policies to optimize the upstream chain

Participants noted an excessive focus on moving downstream in the value chain, overlooking the untapped potential upstream, including personnel training and supplier development. In this regard, it was mentioned that the production of battery-grade or technical-grade lithium carbonate, following market specifications, is in itself a value-adding process that involves significant learning. Thus, several participants agreed on the need to avoid attempting to "make the car before the wheel". This signifies the importance of prioritizing downstream progress only after mastering lithium carbonate production and optimizing connections with the productive infrastructure and the available scientific-technological resources in each region or country.

Source: elaborated by the authors based on virtual workshops.

A just value chain for brine-based lithium-rich countries

The first survey question queries about the conditions that should be promoted for the lithium battery value chain to be just for the countries where lithium mining takes place (Figure 17.1). The panel highlighted prioritizing community participation , ensuring that they reap economic benefits from lithium mining operations. Subsequently, two conditions for lithium-demanding countries are underlined. The first stresses the necessity that these countries promote compliance with social and environmental standards in mining operations. The second is that they encourage the transfer of productive and technological capabilities to lithium-rich countries. The next condition is linked to the previous one, as it advocates for mining countries to diversify their involvement in "downstream" activities within the value chain, with a primary focus on the burgeoning lithium battery sector.

Conditions for a just lithium battery value chain (*)

Taking into account the information reported on the results of Round 1, what CONDITIONS should be promoted so that the lithium battery value chain becomes JUST? Indicate the four most important ones, ranking them from 1 to 4 (1 being the most important).

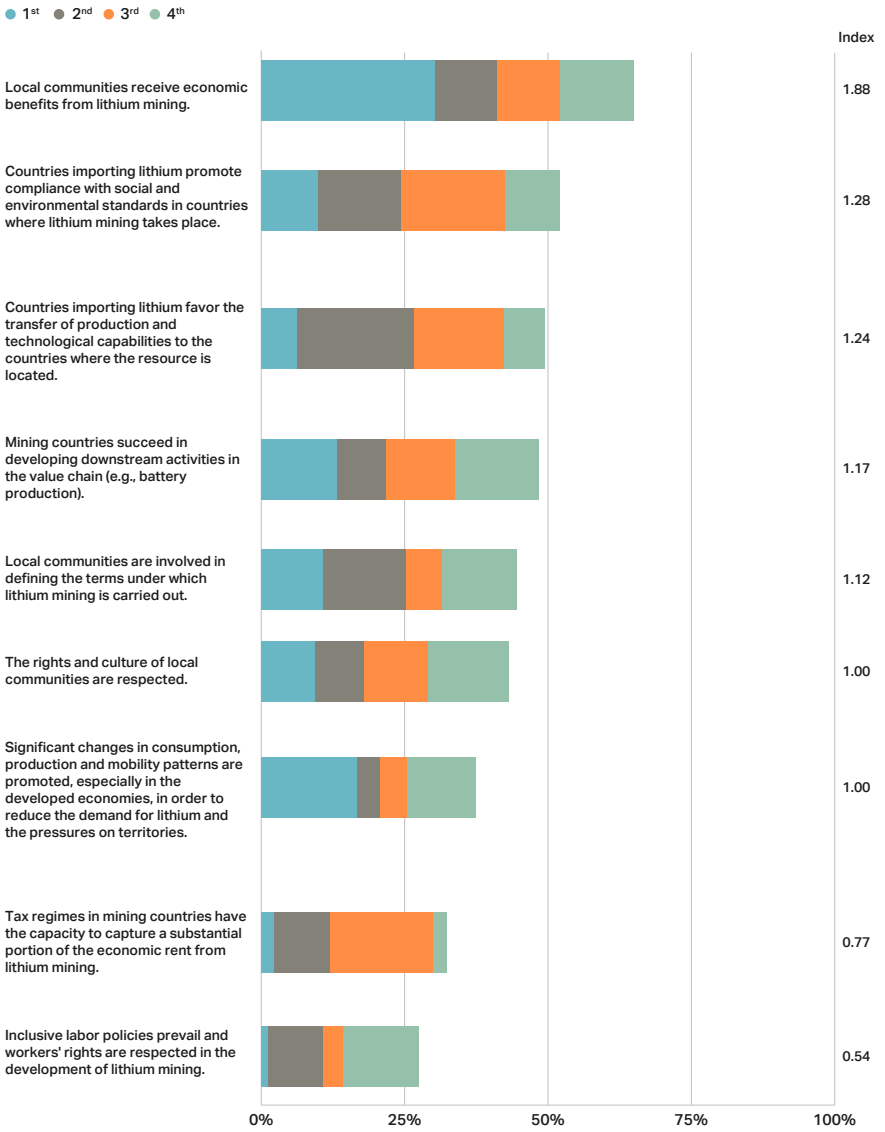


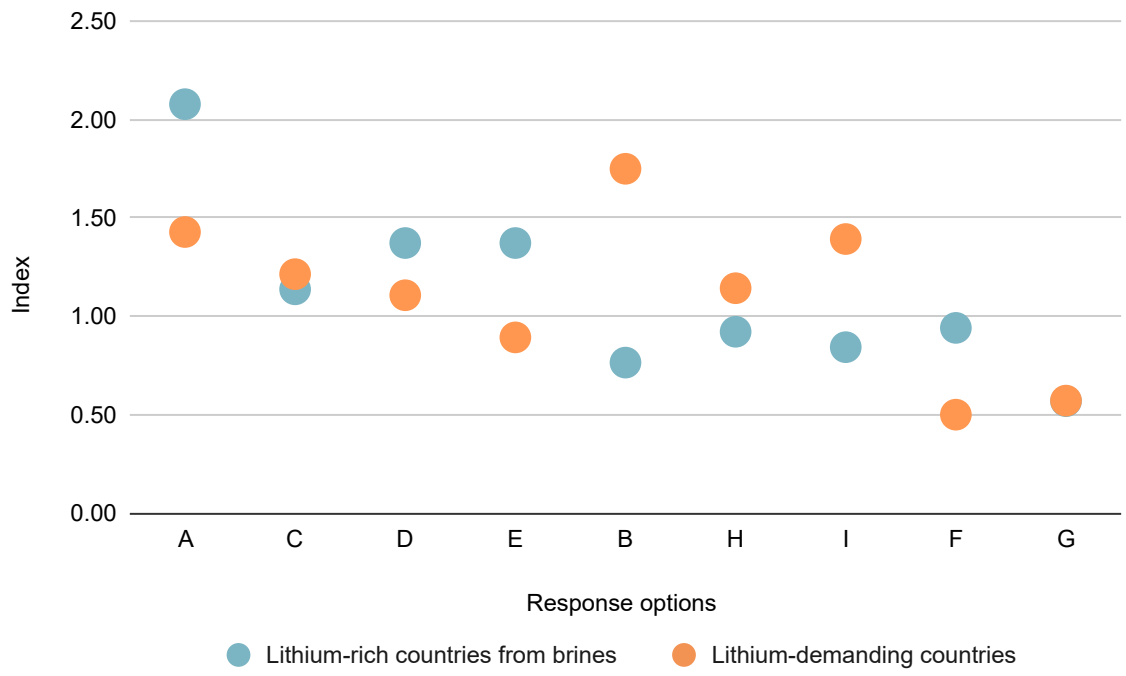
Figure 17.1

(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning each response a value of 4 when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained.

The responses categorized by the participants' countries of residence show differences in their perceptions of a just lithium battery value chain. Those from lithium-demanding countries focus on empowering local communities in regions where lithium mining is prevalent. Their focal points encompass active community involvement in shaping mining practices and reaping the associated benefits (Options B and A, Figure 17.2). They also stress the need for significant changes in consumption, production and mobility patterns to alleviate the pressure on these territories (Option I, Figure 17.2). In contrast, participants from lithium-rich countries, while acknowledging the importance of improving local community participation in the economic benefits of mining (Option A), prioritize advancing "downstream" developments within the value chain (Option E). The path to move in that direction entails the transfer of productive and technological capabilities from lithium-demanding countries as a pivotal goal (Option D, Figure 17.2).

Conditions for a just lithium battery value chain according to the country of residence of the panelists (*)

Figure 17.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

References. Response options for figures 17.2 and 17.3

Table 15

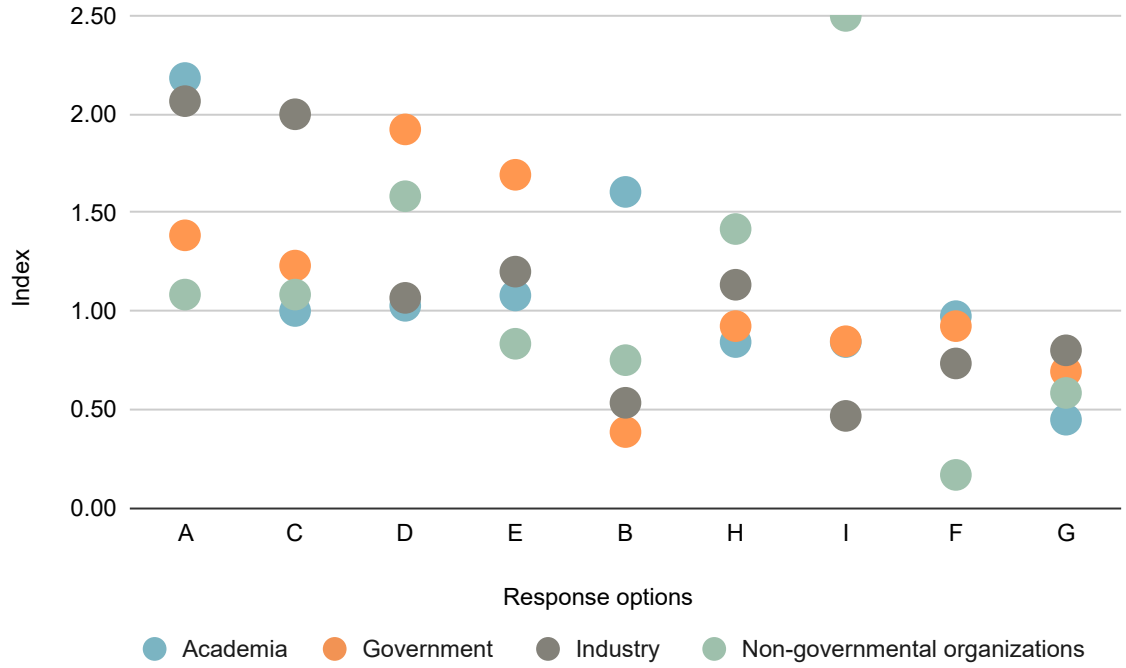
Reference	Option
A	Local communities derive economic benefits from lithium mining.
B	Local communities are involved in defining the terms under which lithium mining is carried out.
C	Countries importing lithium promote compliance with social and environmental standards in countries where lithium mining takes place.
D	Countries importing lithium favor the transfer of production and technological capabilities to the countries where the resource is located.
E	Mining countries succeed in developing downstream activities in the value chain (e.g., battery production).
F	Tax regimes in mining countries have the capacity to capture a substantial portion of the economic rent from lithium mining.
G	Inclusive labor policies prevail and workers' rights are respected in the development of lithium mining.
H	The rights and culture of local communities are respected.
I	Significant changes in consumption, production and mobility patterns are promoted, especially in the developed economies, in order to reduce the demand for lithium and the pressures on territories.

The analysis of responses by stakeholder group indicates significant discrepancies. Participants from academia and industry gave high priority to community participation in the economic benefits of mining, while this condition was less relevant for participants from government and NGOs (Option A, Figure 17.3). Government representatives prioritize capability building and the development of "downstream" activities in the value chain. For NGOs representatives the top-ranked condition is fostering significant changes in production, consumption and mobility patterns (Options D, E and I, Figure 17.3). Concerning the role of lithium-demanding countries also show significant differences. Industry participants, in particular, prioritize their responsibility in promoting compliance with social and environmental standards (second highest priority condition for them), while the rest of the groups gave this option a much lower value (Option C, Figure 17.3). When it comes to the responsibility of lithium-demanding countries for technology transfer, governments are the group that prioritizes this option the most, closely followed by NGOs (Option D, Figure 17.3). A similar pattern emerges for public sector representatives regarding the development of downstream value chain activities.

A just value chain for brine-based lithium-rich countries

Figure 17.3

Conditions for a just lithium battery value chain per membership group (*)



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

Second, the panel was asked about the obstacles to building a lithium battery value chain that is just to the countries where lithium mining is taking place (Figure 18.1). In this case there is a narrower range of options selected, indicating a more consensus-driven response. The most frequently chosen option highlights the institutional shortcomings and limited state capabilities in mining countries, which hinder the attainment of requisite sustainability standards. The second obstacle, as identified by the panel, is the asymmetry of resources between mining countries and those that demand lithium.

Obstacles hindering the development of a just lithium battery value chain (*)

Taking this information into account, which of these obstacles do you think are the most relevant for the construction of a lithium battery value chain that is just for the countries where mining takes place? Indicate the three most relevant, ranking them from 1 to 3 (1 being the most relevant).

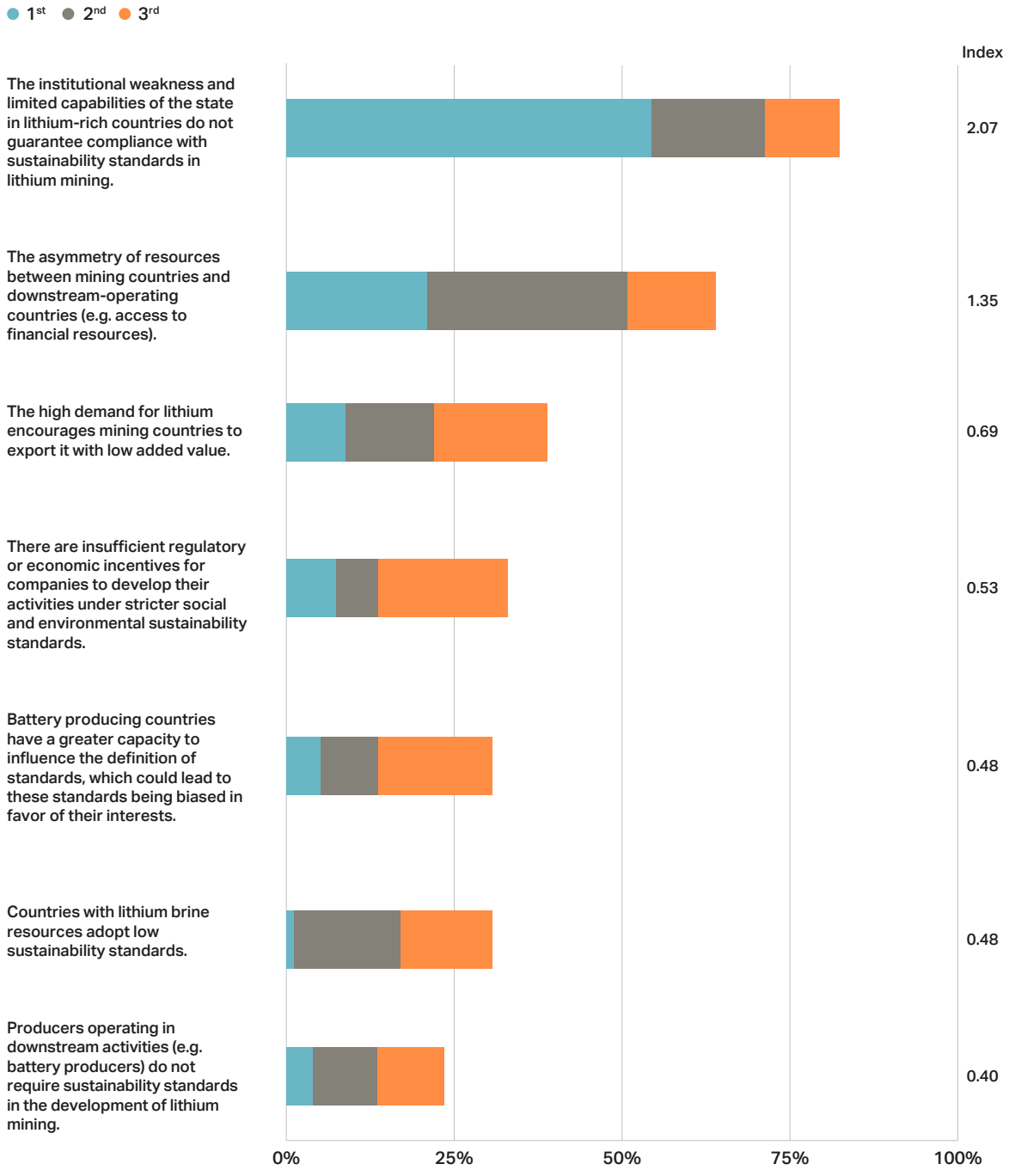


Figure 18.1

(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning each response a value of 3 when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained.

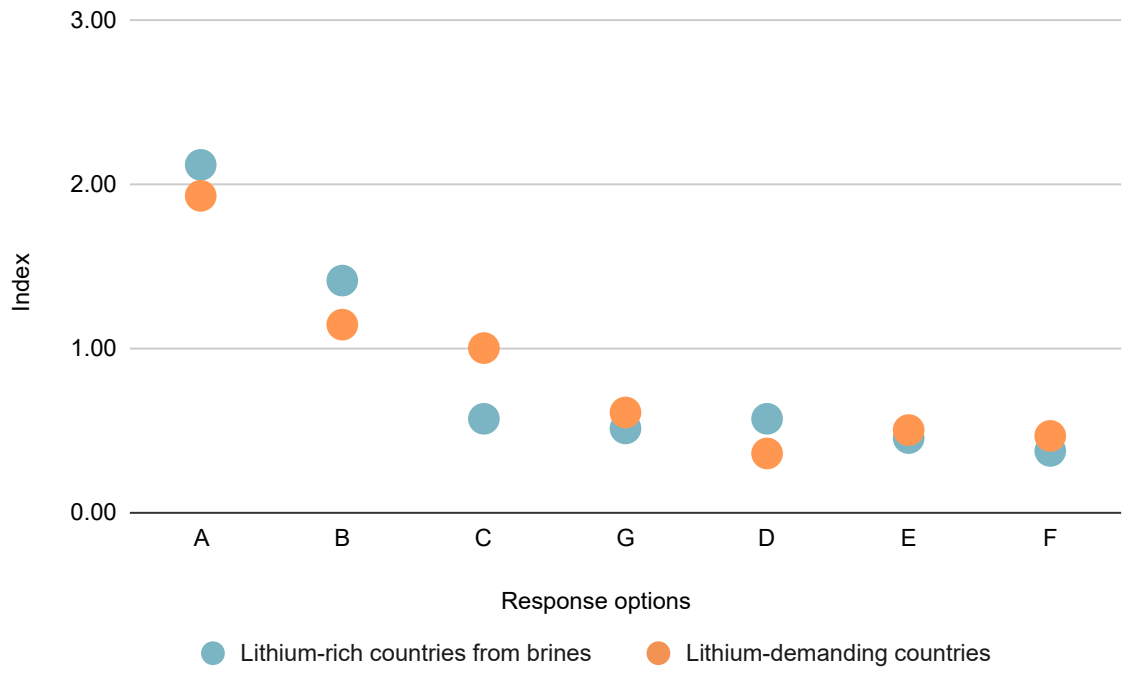
A just value chain for brine-based lithium-rich countries

When the results are broken down by participant's residence, there are no significant differences (Figure 18.2). Notably, both groups align on the importance of the asymmetry of resources as an obstacle to the construction of a more just value chain for lithium mining countries (Option B, Figure 18.2).

The analysis by stakeholder groups reveals a scenario of relative consensus when it comes to the importance attributed to the issue of institutional weakness and the capabilities of mining countries (Option A, Figure 18.3). This was the option with the highest level of prioritization by all groups. As for the issue of resource asymmetry, there is a convergence of views among participants from academia, governments and industry (Option B, Figure 18.3). For these groups, this was the second option in order of preference. Participants from NGOs found this issue to be of lesser significance. They emphasized that the most critical obstacles revolved around the high demand for lithium incentivizing mining countries to exploit the resource with low added value, and these countries adopting lower sustainability standards (Options C and E, Figure 18.3).

Figure 18.2

Obstacles hindering the development of a just lithium battery value chain according to the country of residence of panelists (*)



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

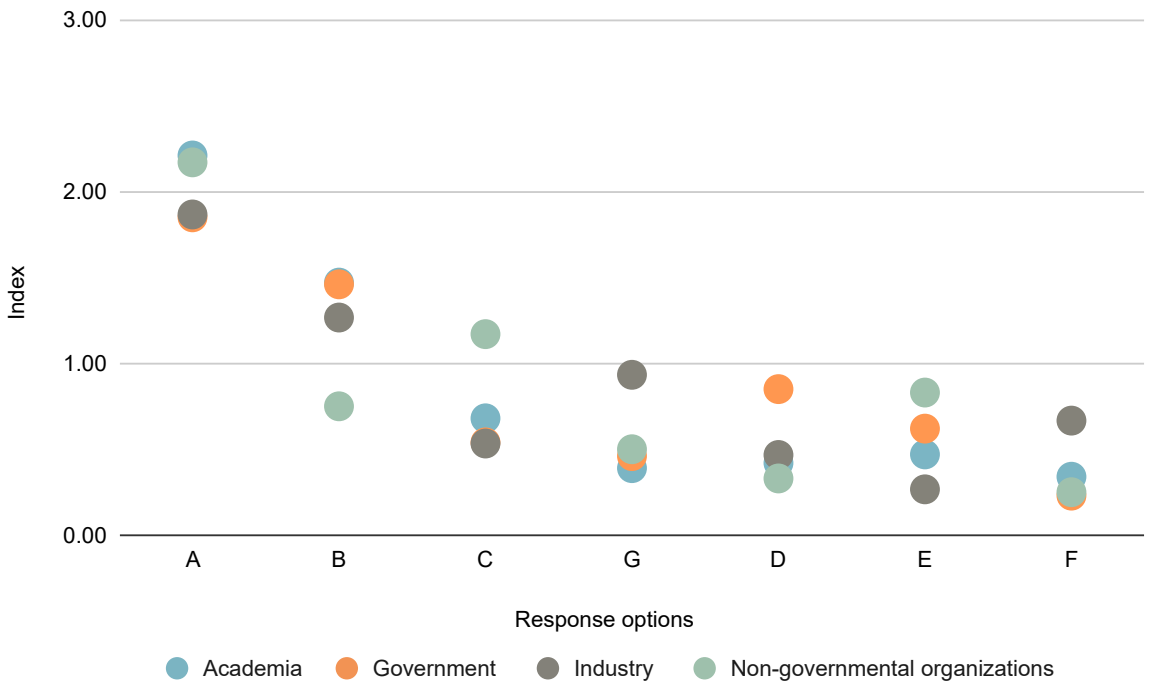
References response options for figures 18.2. and 18.3

Table 16

Reference	Option
A	The institutional weaknesses and limited capacities of the state in lithium-rich countries do not guarantee compliance with sustainability standards in lithium mining.
B	The asymmetry of resources between mining countries and downstream-operating countries (e.g. access to financial resources).
C	The high demand for lithium encourages mining countries to export it with low added value.
D	Battery producing countries have a greater capacity to influence the definition of standards, which could lead to these standards being biased in favor of their interests.
E	Countries with lithium brine resources adopt low sustainability standards.
F	Producers operating in downstream activities (e.g. battery producers) do not require sustainability standards in the development of lithium mining.
G	There are insufficient regulatory or economic incentives for companies to develop their activities under stricter social and environmental sustainability standards.

Obstacles hindering the development of a just lithium battery value chain per membership group (*)

Figure 18.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

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Annex 1. Methodological design

Annex 1. Methodological design

Objectives, methodology and scope

The objective of the Delphi survey was to delve into the primary concerns of stakeholders within the lithium-ion battery value chain regarding sustainability and justice in lithium mining in salt flats. Additionally, it aimed to identify priority actions that should be undertaken to foster the development of a more just and sustainable value chain, as well as determine which actors should lead this process.

The survey follows the Delphi methodology. This type of survey is anonymous and has an iterative dynamic. The survey is developed in several rounds of consultation with a panel of experts on the topic addressed. From the second round onwards, the aggregated results of the previous round are presented, together with a selection of individual responses representative of the different points of view. This process invites the panelists to reflect on their own responses and allows the organizers to examine what are the main challenges, dissensions and consensuses around the topic. The expectation is that knowledge of the opinions of other experts will contribute to the generation of a consensus in the panel (i.e., a lower range of uncertainty about the results). In practice, it is expected that a certain variance in the responses will persist, but this variance is informative of the points on which there is greater or lesser agreement (Calatayud et al., 2020).

This type of survey is used to obtain the opinion of experts or people with extensive experience in complex and controversial issues, when the information available is limited (Beiderbeck et al., 2021; Slocum, 2003). This is justified in that, given the uncertain and complex nature of the processes on which a diagnosis is sought, "the technical knowledge of a group of experts intentionally selected for the purposes of the study allows more valid conclusions to be reached than those that could be reached from a random sample that would allow generalization to a broader population" (Calatayud et al., 2020:11).

The survey convened experts involved in the entire lithium battery value chain. However, it focuses on sustainability and just conditions in the segment corresponding to lithium mining in salt flats.

Implementation team

The survey design and implementation was under the responsibility of researchers from the Argentinean institutions CENIT-EEyN-UNSAM, IIEP-FCE-UBA and Fundar. They were supported by the network of researchers of the Green Dealings project, with special incidence in identifying key issues, reviewing options in closed questions and translating the questionnaires into English.

The CENIT-EEyN-UNSAM and IIEP-FCE-UBA team were the main ones responsible for the conceptual design and formulation of the questionnaires and the recruitment of experts. They also participated in the analysis stage and led the writing process of the reports. The Fundar team participated in the conceptual discussion of the study and the questionnaire design process. It was also responsible for the implementation of the survey, including designing questionnaires in the digital platform, running preliminary tests, sending invitations and follow-ups to the panelists, among other activities. Fundar was also responsible for the data processing and the designing of this report. All the aforementioned institutions collaborated in the process of writing and reviewing the reports.

Annex 1. Methodological design

Recruitment and composition of the panel of experts (March to August 2022)

Following recommendations in the literature, we sought to construct a panel of experts divided according to areas of expertise and knowledge, with the objective of obtaining different points of view on the outcome of interest (Okoli and Pawlowski, 2004). The greater the number of panelists involved, the more points of view will be included in the study and the better the feedback among panel members in the following rounds. Thus, the starting point was a base of more than 600 experts from more than 20 countries, characterized according to their country of residence (and the place that country occupies in the lithium battery value chain), their group of membership, the activity in which they are involved (in relation to the battery value chain), and the segment of the chain to which they are linked. In the process of recruiting the panel of experts, the aim was to achieve diversity in the panel. This would minimize the biases associated with the prevalence of a particular type of profile in the panel (Calatayud, A. et al., 2020). The criteria used to achieve such diversity were:

1. Expertise: relevant knowledge and/or experience on the topics covered by this study.

2. Position in the value chain: residents in countries with different types of participation in the value chain (countries rich in lithium in salt flats and countries demanding lithium).

3. Membership group: government, academia, industry, non-governmental organizations, international organizations and indigenous peoples.

4. Activity in the value chain: production, formulation of public policies and legislation, research and development, representation of interests and defense of rights.

5. Chain segment: exploration, extraction, and production of lithium compounds; production of lithium batteries and their components; production of goods that use lithium batteries; recycling of lithium batteries.

The construction of the database with potential survey participants was carried out through the network of contacts of the implementing team. To this initial set were added contacts provided by experts and institutional partners of the Green Dealings project. Of the identified stakeholders, 622 were contacted to participate in the survey through a formal recruitment email, obtaining a response rate (for Round 1) of 22.7% (141 participants). The "Panel composition" section of this report describes the panel's composition by membership group and position in the value chain.

It should be clarified that, with one exception, it was not possible to involve members of indigenous communities in the survey. Difficulties of access to connectivity for these communities represented an obstacle, given the virtual and anonymous nature of the survey. Undoubtedly, this represents a limitation for the interpretation of the results since these communities are among the main ones affected by the sustainability problems of lithium mining.

Annex 1. Methodological design

Conceptual design of the survey and development of questionnaires (March to August 2022)

The survey was conducted in two rounds, encompassing both Spanish and English languages. This approach was adopted to ensure a comprehensive panel encompassing diverse geographic regions. For Round 1, a questionnaire comprising 22 questions was developed, incorporating a balanced mix of open and closed-question formats. It included 8 open-ended questions, 8 closed multiple-choice questions, and 6 closed questions focused on participant identification data, such as gender, age, country of residence, group affiliation, and involvement in specific value chain segments and productive activities (Table A1).

The open questions refer to the main challenges, conditions and obstacles to sustainability, justice and governance of lithium mining and about actors and public policy initiatives and instruments to address them. In the literature there are diverse meanings of the concepts of "sustainability" and "justice", associated with different disciplinary currents and theoretical frameworks. The survey questionnaires did not provide an explicit definition of these concepts. The questionnaire provided a graphic definition of the lithium battery value chain. Likewise, the Round 1 questionnaire provided the following definition of the concept of "governance":

> Governance refers to the decision-making processes on natural resource management that result from interactions and negotiations between various actors (governmental and non-governmental). These processes encompass different dimensions including ownership, access, extraction, use, monitoring and conservation of resources, as well as the appropriation and distribution of the economic rent associated with them.

The open-ended questions inquired about the key challenges, conditions, and obstacles related to sustainability, justice, and governance in the context of lithium mining. Additionally, sought to identify relevant actors and public policy initiatives to address these challenges. The purpose of these open questions was to gather a comprehensive understanding of the panel's viewpoints, essentially creating an "inventory" of issues deemed relevant by participants. This approach was valuable in identifying response options that may not have been covered in the closed-ended questions of the same thematic axis. Consequently, it allowed for the inclusion of new options in the second round of the survey, ensuring a more comprehensive exploration of the subject matter.

Annex 1. Methodological design

Number of questions per section and survey round

Table A1

Question type	Round 1 (n = 22)					Round 2 (n =14)	
	Sustainability	Justice	Governance	Initiatives, instruments and actors	Id data	Sustainability	Justice
Open-ended	1	2	1	4	0	0	0
Close-ended	5	2	1	0	6	11	2
Statements	0	0	0	0	0	1	0
Total	6	4	2	4	6	12	2

Source: questionnaires of Round 1 and 2.

After each open-ended question, a corresponding closed multiple-choice question was presented. The closed question provided a set of statements related to sustainability, and panelists were requested to rank their preferences among 3 or 4 options. The formulation of the multiple-choice questions is the result of an iterative process. The implementation team initiated the process by conducting a brainstorming session to identify the primary sustainability and justice challenges associated with lithium mining in salt flats and potential strategies or instruments to tackle these issues. Subsequently, an extensive review of academic and non-academic literature was undertaken to further refine the initial formulation. This encompassed analyzing company reports, international organizations' publications, and other relevant sources to gather valuable insights and ensure a comprehensive understanding of the subject matter. Then, at least six formulation sessions were held in which the implementation team synthesized the questions and statements. As a next step, the terminology used was revised, and the length of the statements was shortened.

As a next step, the terminology used was revised and the length of the statements was shortened.

Round 2 of the survey was structured into three sections. The first section focused on sustainability and consisted of 13 closed multiple-choice questions. Participants were provided with the Round 1 results and were asked three related questions: the first one reiterated the priority challenges, the second one sought information on initiatives or instruments to address those challenges, and the third one inquired about the key actors responsible for implementing such initiatives. In each case, the option "Other (specify)" was included among the response options, allowing participants to provide additional inputs.

The second section centered around the topic of justice. The Round 1 results were presented, and two closed multiple-choice questions were posed to gauge any changes in the panel's opinions regarding conditions and obstacles to achieving a more equitable approach to lithium mining in salt flats.

The third section featured a single question consisting of six statements. Participants were asked to express their level of agreement or disagreement with these statements using a 7-level Likert scale (Table 1). The statements were formulated based on the findings of Round 1. The purpose of employing a Likert scale was to assess the degree of consensus that could be reached among the entire panel in relation to these statements.

Annex 1. Methodological design

Survey implementation (August to December 2022)

The survey was conducted virtually, with participants providing their responses under confidentiality conditions. It was emphasized that the survey was answered in a personal capacity, and the institutional positions of member organizations were not consulted or considered. This approach aimed to ensure unbiased and independent perspectives from participants. The Survey Monkey platform was used to make the survey available in virtual format. The decision was made after testing alternative platforms that presented some limitations to formulating the type of questions we intended to ask.

After sending a formal invitation to participate in the survey by email, a systematic follow-up was carried out to involve as many people as possible. To encourage participation, periodic reminders were sent to individuals who had either not yet begun or had partially completed the survey, notifying them of the opportunity to participate and reminding them of the survey deadline. In the initial email of invitation as well as in the successive reminders and in the introductory part of the Round 1 questionnaire, the respondents were urged to invite other colleagues who, by virtue of their experience and knowledge, could also participate/take part in the survey.

Round 1 of the survey was open from August 29th, 2022 (the day the invitation mailing was sent) up to and including September 25th. Responses were processed at the aggregate level three weeks after the deadline. In the case of the open-ended questions, this involved coding the respondents' answers. These questions referred to the challenges to sustainability; the conditions and obstacles to building a just value chain for lithium-rich countries in salt flats; the governance challenges; and the initiatives and instruments to address the challenges identified and promote a just chain, as well as the actors that should lead these initiatives.

The coding process was based on the response options of the closed-ended questions. When the response could not be classified in any of the options offered by the questionnaire, categories were created to capture the panel's answers adequately. The coding process was carried out by two research assistants whose work was divided in half: four open-ended questions were coded by one of the assistants, while the remaining four were by the other assistant.

At the end of the work, a cross-coding exercise was carried out to validate the coding criteria: 10% of the responses to each question were randomly selected, and the roles of the coding assistants were reversed. After coding this sample, the codes chosen in this revision instance were contrasted with those chosen in the first instance.

After six weeks of processing, the survey results were interpreted, and the Round 2 questionnaire was designed. In addition, new questions were asked about initiatives to address the challenges to sustainability and justice in the chain and the actors who should promote these initiatives. The responses gathered from the open-ended questions served as valuable input for formulating the response options provided to respondents in this particular instance.

The questionnaire design for Round 2 involved an iterative process in defining the final formulation of the 14 closed multiple-choice questions. The questions in Round 2 aimed to validate the priority challenges identified by the panel in Round 1 and identify the initiatives required to address them and the key actors who should be involved. Furthermore, the survey included six statements based on the open-ended questions from Round 1. Participants were asked to express their level of agreement or disagreement with these statements, allowing for a deeper understanding of the panel's perspectives and the consensus reached on these issues.

The deadline to participate in the second round began on November 17th. 2022, with a formal invitation email and ended on December 20th. The survey was sent exclusively to those participating in the first round. On this occasion, 83 people participated out of 141 invitees, representing 58% of the original panel.

At the end of December 2022, we decided to close the survey after round 2. The decision was mainly based on the fact that a certain degree of consensus had been achieved on the key issues investigated, as evidenced by the low variability in the responses provided in each round.

Results processing and preparation of the executive and final reports (January to September 2023)

After the deadline to participate in the second round, during the following weeks the results of the survey were processed in aggregate terms and compared with the results of the first round. A disaggregated analysis of the results was also carried out by cross-referencing the responses according to the country of residence and group to which the experts belonged.

In general, the panel's composition remained consistent in terms of the respondent's place of residence, group affiliation, and professional activities, with only minor observed variations. The relative participation of respondents from lithium-rich countries from salt flats decreased by 6.6 percentage points (from 66.7% to 60.2%). There was also an increase of 8.9 percentage points in the relative participation of the academic sector (from 36.9% to 45.8%) and a decrease of 6.7 percentage points in the relative participation of industry (from 24.8% to 18.1%). Likewise, there was a fall of 6 percentage points in the relative participation of respondents linked to production activities. For this comparative analysis, the responses of the 141 Round 1 respondents were taken into account, and the aggregate results were compared with the responses of the 83 Round 2 respondents. The objective was to evaluate possible variations in the responses between the two rounds and thus identify emerging consensus or whether there were ongoing disagreements on any of the issues addressed in the study. Generally speaking, there was little variation between rounds. The challenges identified as priorities in Round 1 of the survey retained their position in the second consultation.

Given that participation between rounds decreased by 42%, and that this could alter the relative composition of the panel in terms of the personal characteristics of the respondents, a cross-checking exercise was carried out to verify that the results of Round 2 were not sensitive to these changes in the composition of the panel. Thus, the Round 1 results were processed again, but this time restricting the sample to those respondents who had also participated in Round 2. In doing so, no substantial modification in the results was observed, so it is concluded that the results of the study are not conditioned by changes in the composition of the panel between rounds.

Unlike the first round questionnaire, below the response options for the multiple-choice questions, a space entitled "Other" was included so that respondents could provide spontaneous responses, indicating options that were not present in the list. This was a complementary addition, which did not replace the requirement for respondents to mark the three or four options on the list requested by the questionnaire in order to be able to move on to the next question. The answers given in the "Other" option were processed in order to identify possible challenges, initiatives or actors that were not covered in the options offered. Responses that had made use of the "Other" option were then coded. To make this evaluation, a threshold of 5% of the panel was established, discarding those categories that, although not present in the closed list of options, did not exceed this value. The results of the processing showed that in this set of spontaneous responses no category was identified that was not included in the list and exceeded the threshold established to be considered relevant.

Annex 1. Methodological design

The data was broken down by the participants' country of residence using the following classification: (i) brine-based lithium-rich countries and (ii) lithium-demanding countries. The first category included respondents residing in Argentina, Chile and Bolivia, and excluded participants residing in countries rich in lithium from other extraction sources. The group of lithium-demanding countries included respondents residing in Europe, Canada and the United States. Responses from individuals who didn't fit within either of these two categories were not considered in the disaggregated analysis.

In the analyses based on stakeholder groups, we considered four out of the six categories initially outlined in the questionnaire: (i) academia, (ii) government, (iii) industry and (iv) non-governmental organizations. Our inclusion criterion was that each category should represent at least 12% of the total observations. Consequently, categories that did not meet this threshold (specifically, indigenous peoples and international organizations) were excluded from the analysis, and their responses were not considered in the disaggregated analysis.

During the first half of 2023, progress was made in assembling and selecting the graphs and results that were incorporated into the preparation of this document.

In June 2023, three virtual multi-stakeholder workshops were convened with the primary aim of presenting and engaging in discussions regarding the initial findings of the Delphi survey. These workshops were specifically designed to identify obstacles and deliberate on potential solutions for the challenges identified, with a focus on fostering a collaborative approach to governance. The first workshop was attended by industry stakeholders (18 participants), the second by members of academia and NGOs (21 participants) and the third by members of government and international organizations (23 participants). These workshops lasted approximately 90 minutes each and attracted specialists from various countries, notably Argentina, Bolivia, and Chile.

The workshops were moderated by two facilitators who structured the sessions into five distinct stages. First, the preliminary results of the Delphi survey were presented and validated. Participants were invited to answer the following questions: "Is there any crucial information missing from the survey?" and "Are there aspects that significantly deviate from your own experiences?". Second, a force field analysis was conducted. Participants were tasked with identifying the driving forces that support collaborative governance to tackle the sustainability challenges in lithium mining, as well as the opposing factors. Their collective insights were then aggregated into a shared mural.

The third part of the workshop was structured into groups organized around three thematic areas derived from the survey: 1) impacts on water (water balance in salt flats) and biodiversity; 2) the involvement of local communities in sharing the economic benefits of lithium mining; and 3) the linkages with the production sector and the science and technology system in countries rich in lithium brine. For the workshop attended by government participants, a fourth theme was introduced: institutional weaknesses and state capacities in countries with abundant lithium in brine. In each group, discussions were structured around four key questions: 1) Based on your experience, what is not working effectively, and why?; 2) What could be a viable solution?; 3) How can collaborative governance on this matter be improved?; and 4) What could be improved?. Finally, a plenary was held to summarize the primary conclusions and insights from each group.

Annex 2. Results 1st Round

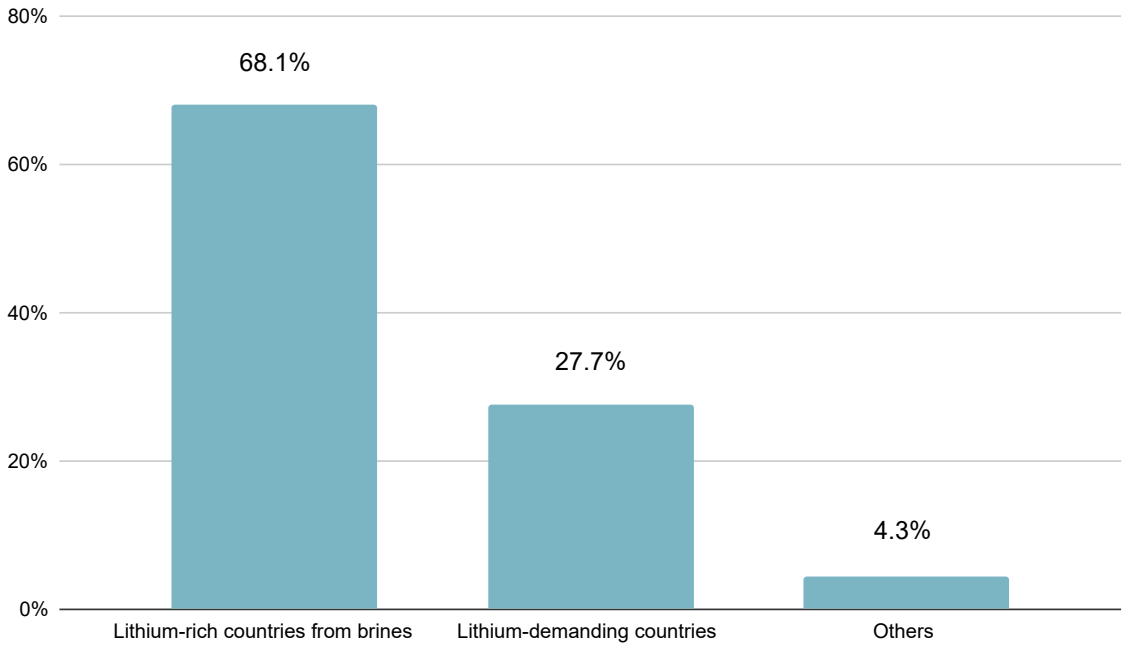
Annex 2. Results 1st Round

Annex 2.
Results 1st Round

Panel composition

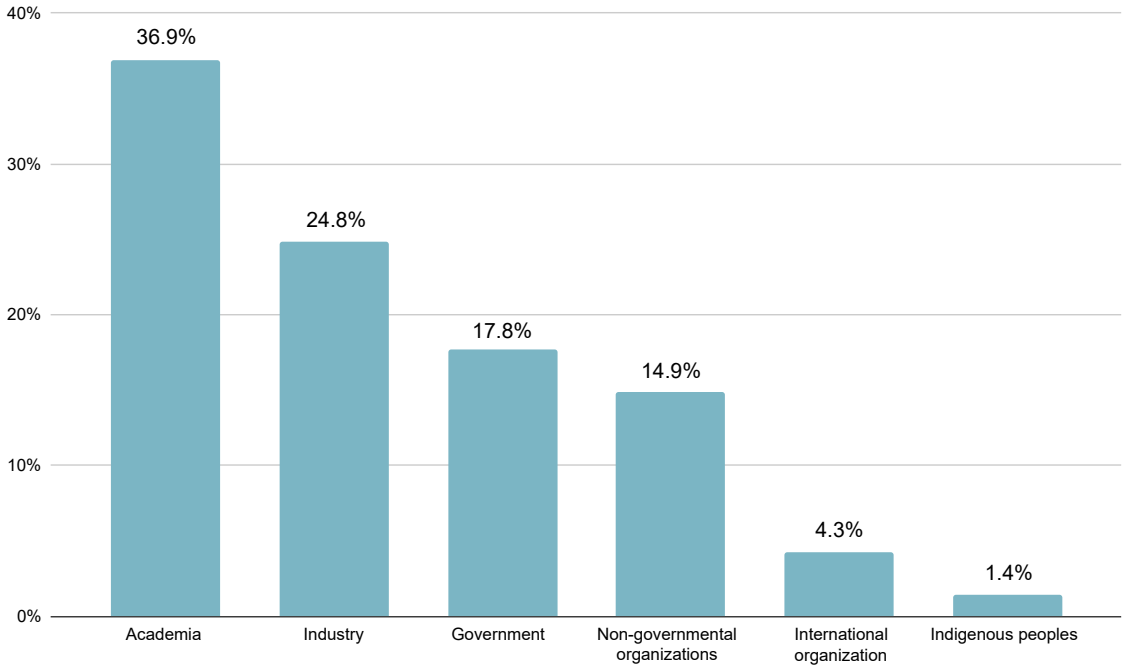
Panelists' position in the value chain (Round 1)

Figure 19



Panel membership group (Round 1)

Figure 20



Annex 2.
Results 1st Round

Sustainability of lithium mining in salt flats

Sustainability problems of lithium mining (Round 1)

Based on your experience and knowledge of the activity and territory, you would say that lithium mining in salt flats has...

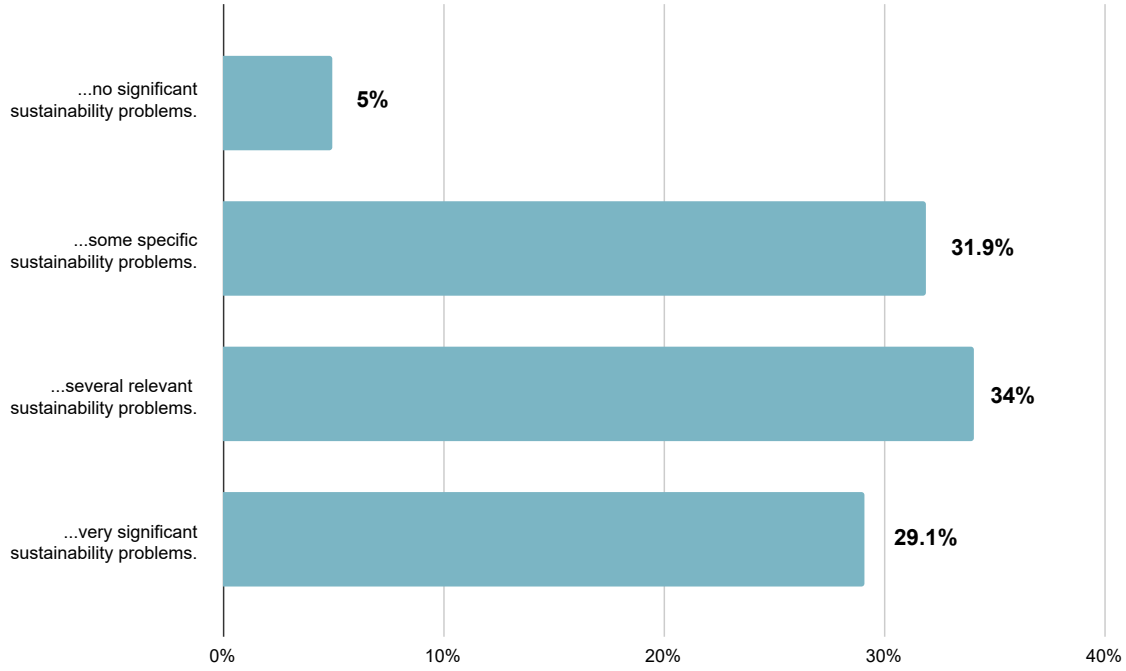


Figure 21.1

Sustainability problems of lithium mining according to the country of residence of the panelists (Round 1) (*)

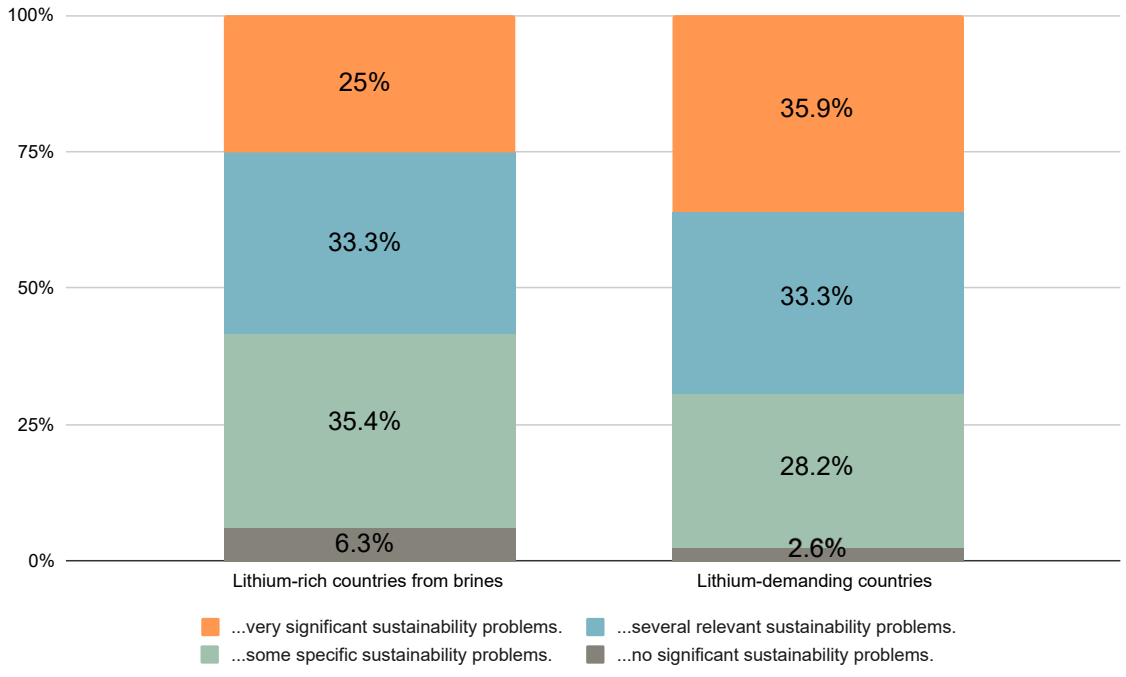


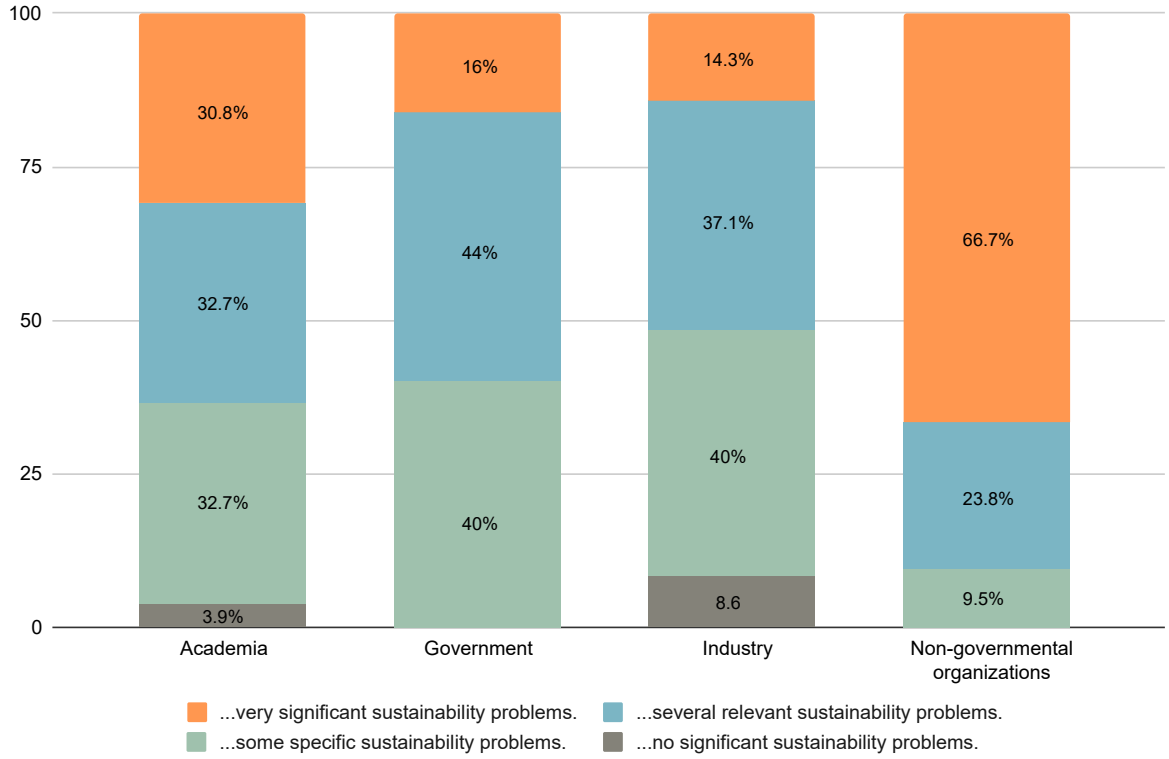
Figure 21.2

Annex 2. Results 1st Round

(*) Methodological note: the graph shows the distribution of responses according to the panelists' country of residence. The extension of the bar reaches 100% because it disaggregates the total responses within a group. The color code indicates what percentage of the group chose that response option.

Figure 21.3

Sustainability problems of lithium mining per membership group (*) (Round 1)



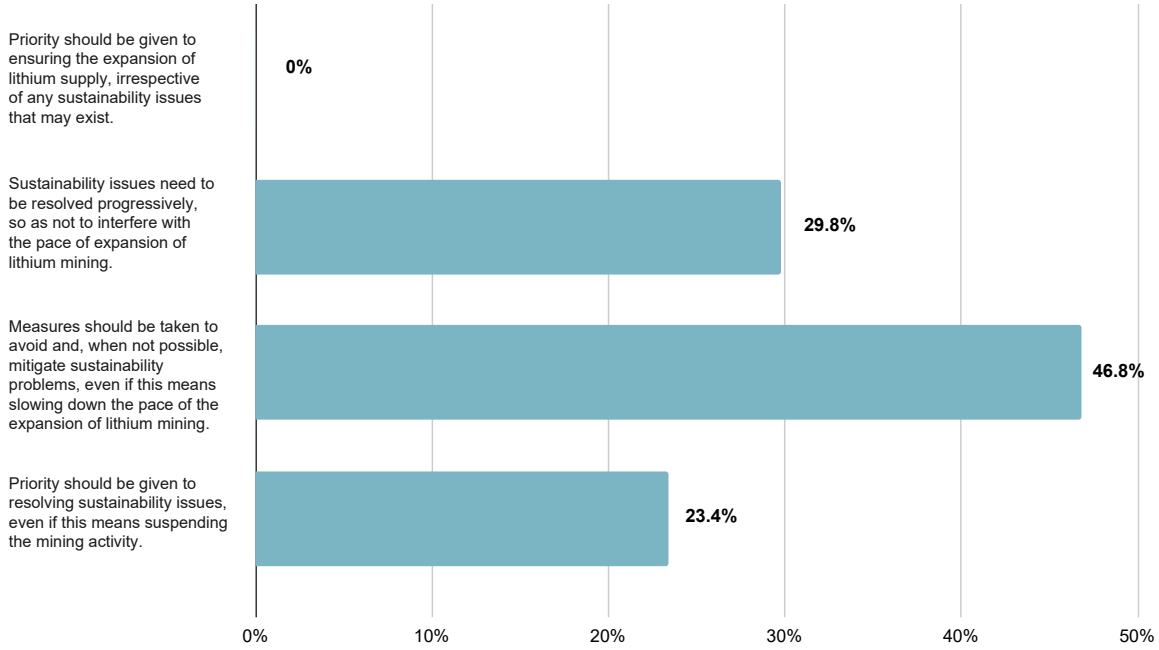
(*) Methodological note: the graph shows the distribution of responses per membership group. The extension of the bar reaches 100% because it disaggregates the total responses within a group. The color code indicates what percentage of the group chose that response option.

Annex 2.
Results 1st Round

Sustainability and courses of action for lithium mining (Round 1)

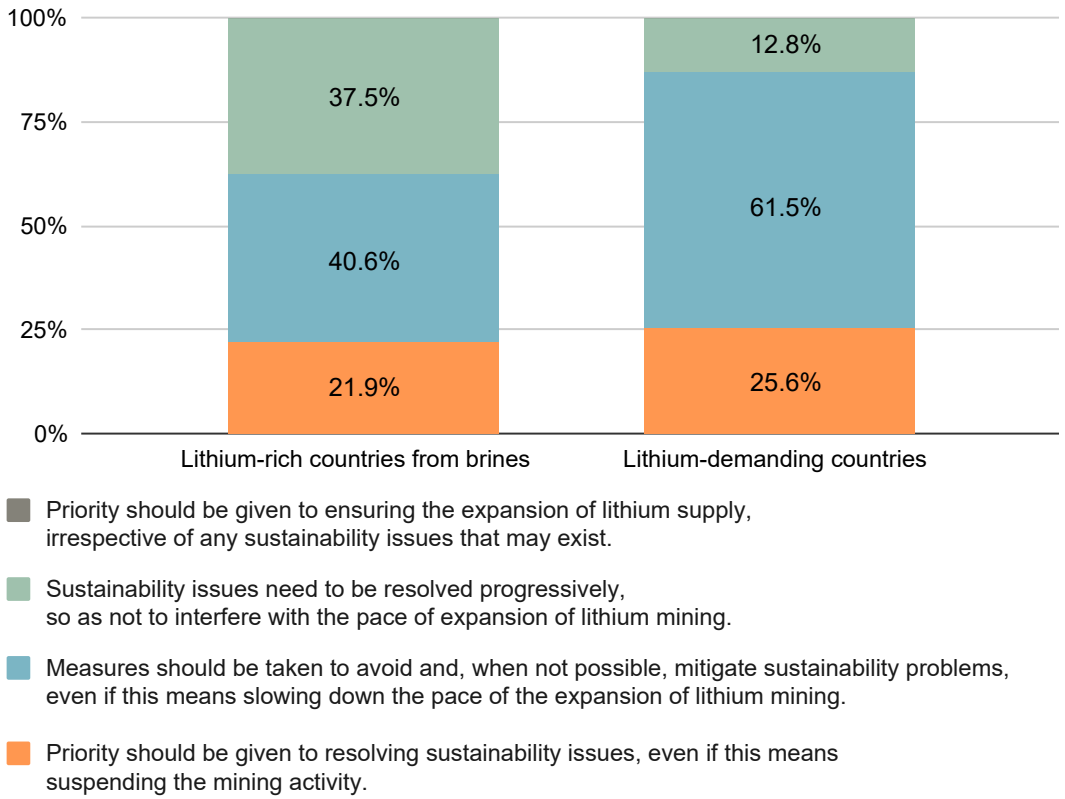
Considering your last answer, select from below the course of action that seems the most appropriate to you.

Figure 22.1



Sustainability and courses of action for lithium mining according to the country of residence of the panelists (Round 1) (*)

Figure 22.2

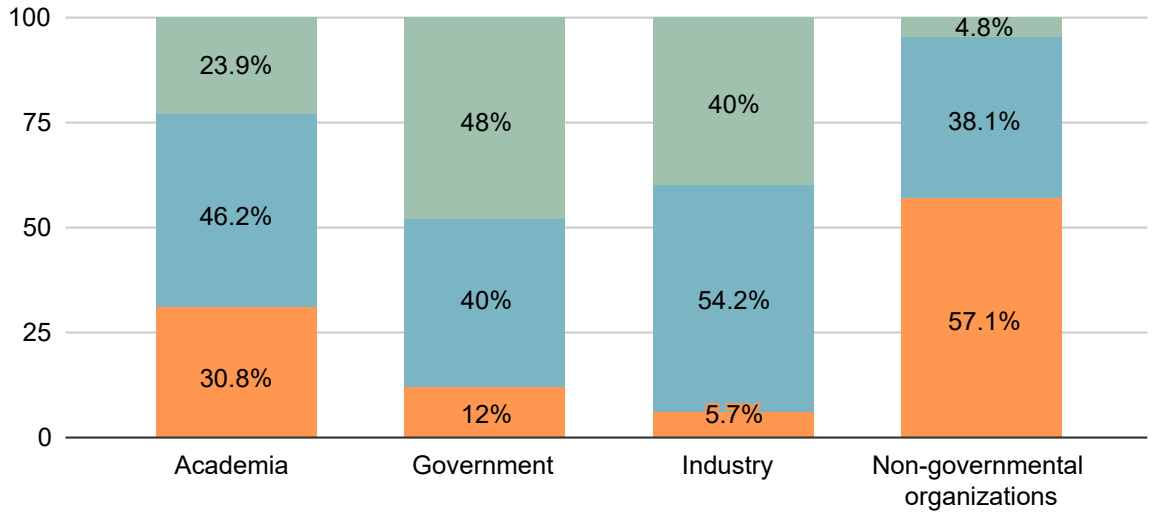


(*) Methodological note: the graph shows the distribution of responses according to the panelists' country of residence. The extension of the bar reaches 100% because it disaggregates the total responses within a group. The color code indicates what percentage of the group chose that response option.

Annex 2.
Results 1st Round

Sustainability and courses of action for lithium mining per membership group (Round 1) (*)

Figure 22.3



Priority should be given to ensuring the expansion of lithium supply, irrespective of any sustainability issues that may exist.

Sustainability issues need to be resolved progressively, so as not to interfere with the pace of expansion of lithium mining.

Measures should be taken to avoid and, when not possible, mitigate sustainability problems, even if this means slowing down the pace of the expansion of lithium mining.

Priority should be given to resolving sustainability issues, even if this means suspending the mining activity.

(*) Methodological note: the graph shows the distribution of responses per membership group. The extension of the bar reaches 100% because it disaggregates the total responses within a group. The color code indicates what percentage of the group chose that response option.

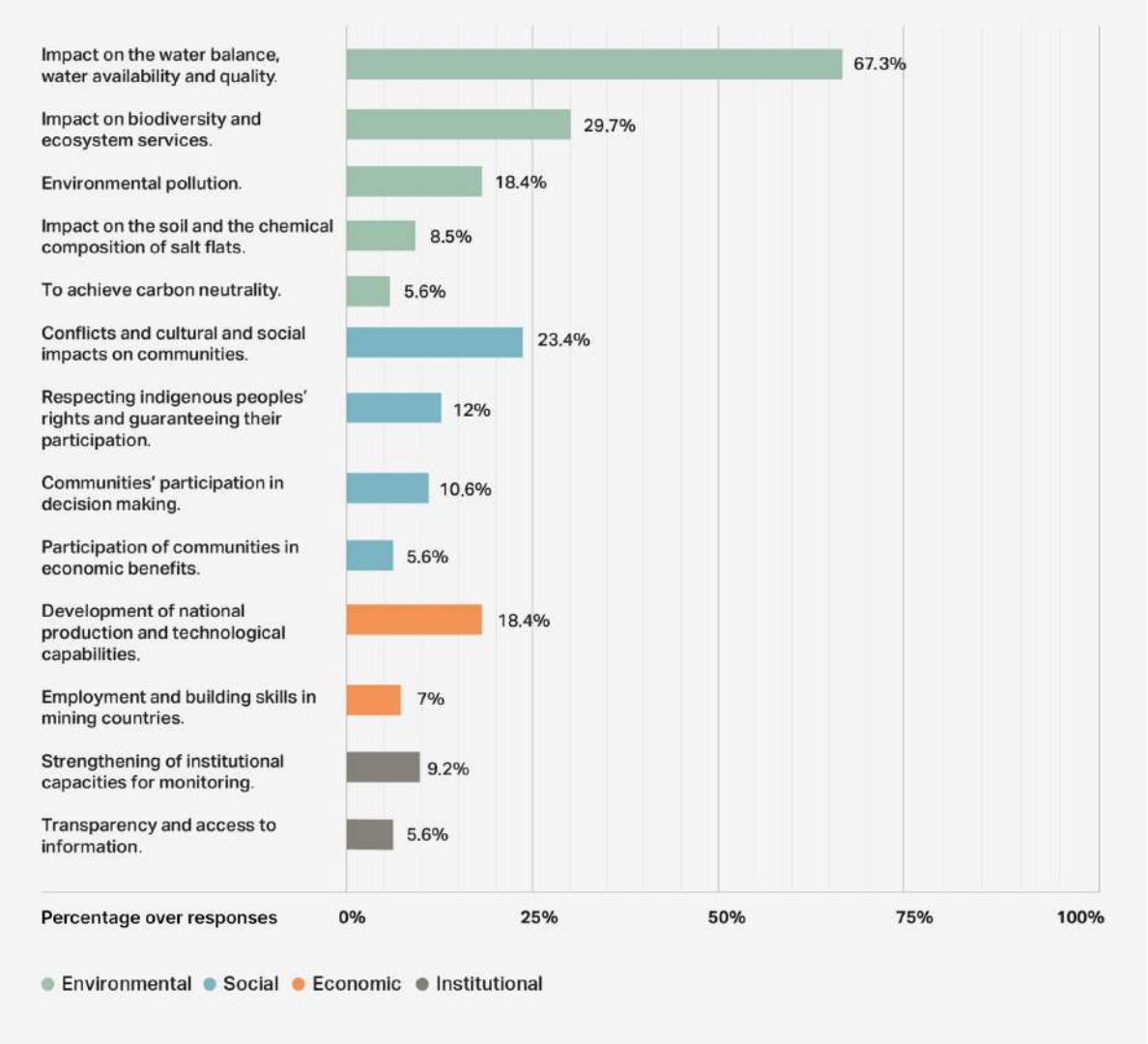
Annex 2.
Results 1st Round

Sustainability of lithium mining in salt flats

Main challenges for the sustainability of lithium mining in salt flats (Round 1) (*)

Which are the main sustainability challenges of lithium mining in salt flats?

Figure 23



(*) Methodological note: On the left side of the graph, you can observe the categories derived from the coding process. The numbers at the end of each bar represent the percentage of the panel that included the respective category in their responses. Environmental challenges are represented by the green bars, while social, economic, and institutional challenges are represented by the blue, orange, and gray bars. It is important to note that the total percentage for each category exceeds 100% because participants were allowed to provide multiple answers. Categories with a participation rate of less than 5% in the aggregate responses of the panel are not reported.

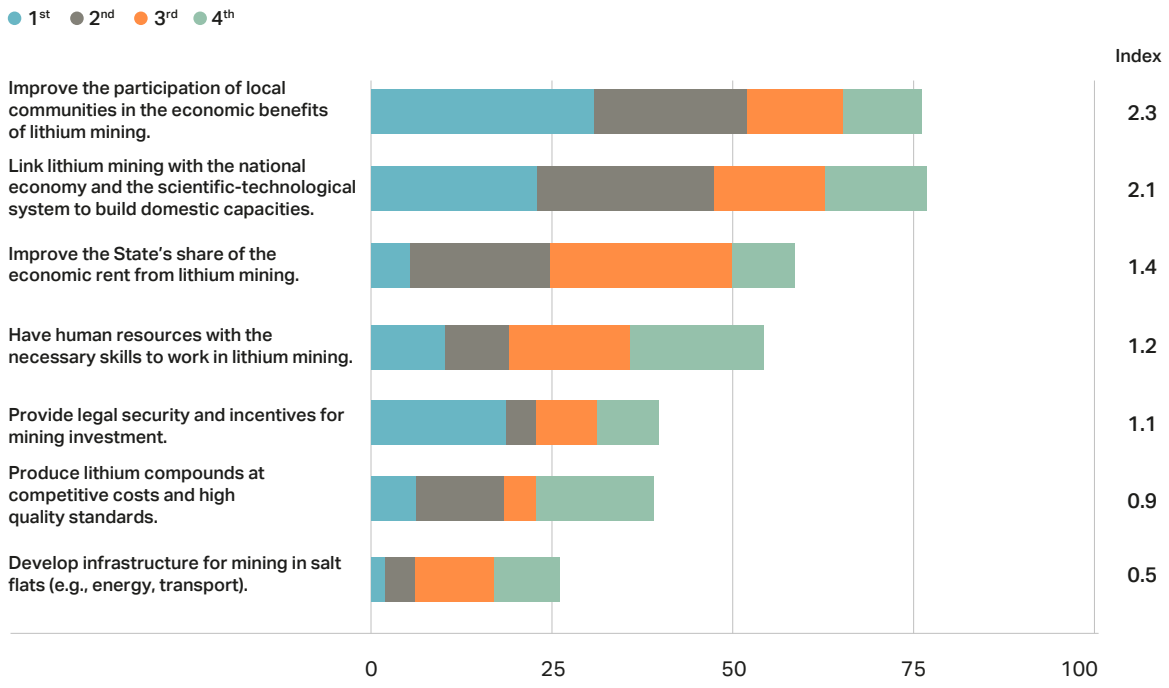
Annex 2.
Results 1st Round

Economic sustainability[7]

Main challenges for the economic sustainability of lithium mining in salt flats (Round 1) (*)

Which of the following economic sustainability challenges should be addressed as a priority? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

Figure 24.1



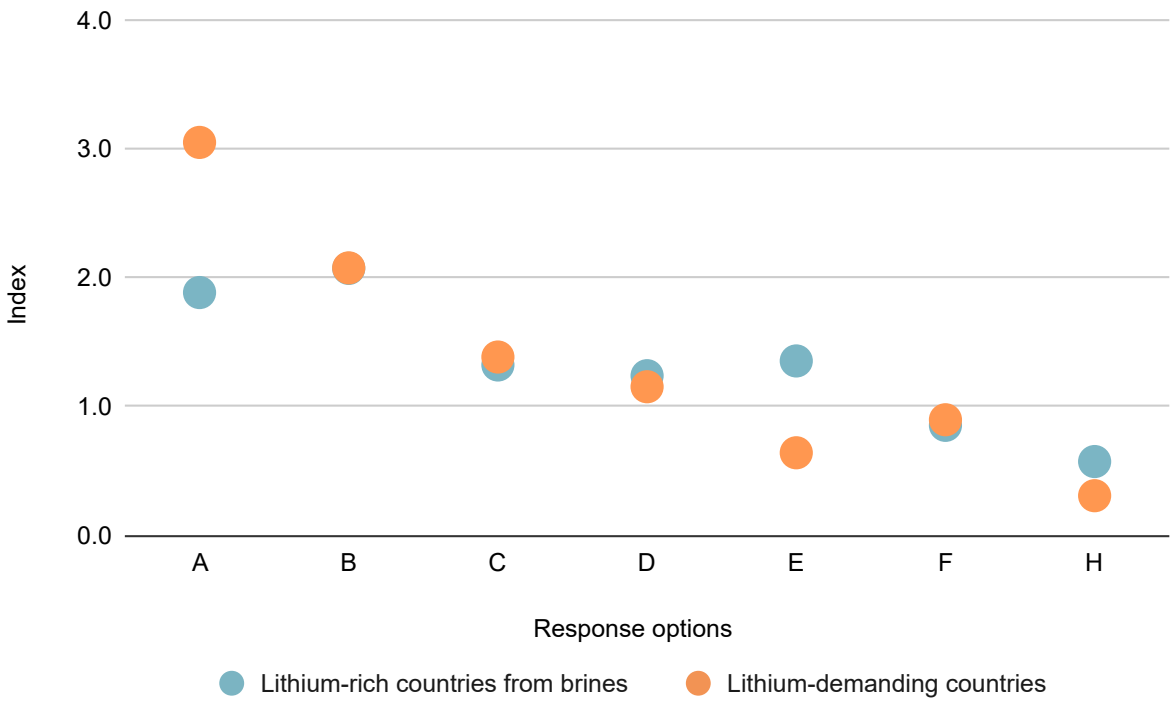
(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning each response a value of 4 when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained.

7 The order followed in this Annex to present the three dimensions of sustainability differs from the order in which they were presented in the rest of the report when reporting the results of Round 2. To report the results of Round 1 it was decided to follow the order of the questions established in the questionnaire.

Annex 2.
Results 1st Round

Main challenges for the economic sustainability of lithium mining in salt flats according to the country of residence of the panelists (Round 1) (*)

Figure 24.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

Table 17. References. Response options for figures 24.2 and 24.3 (Round 1)

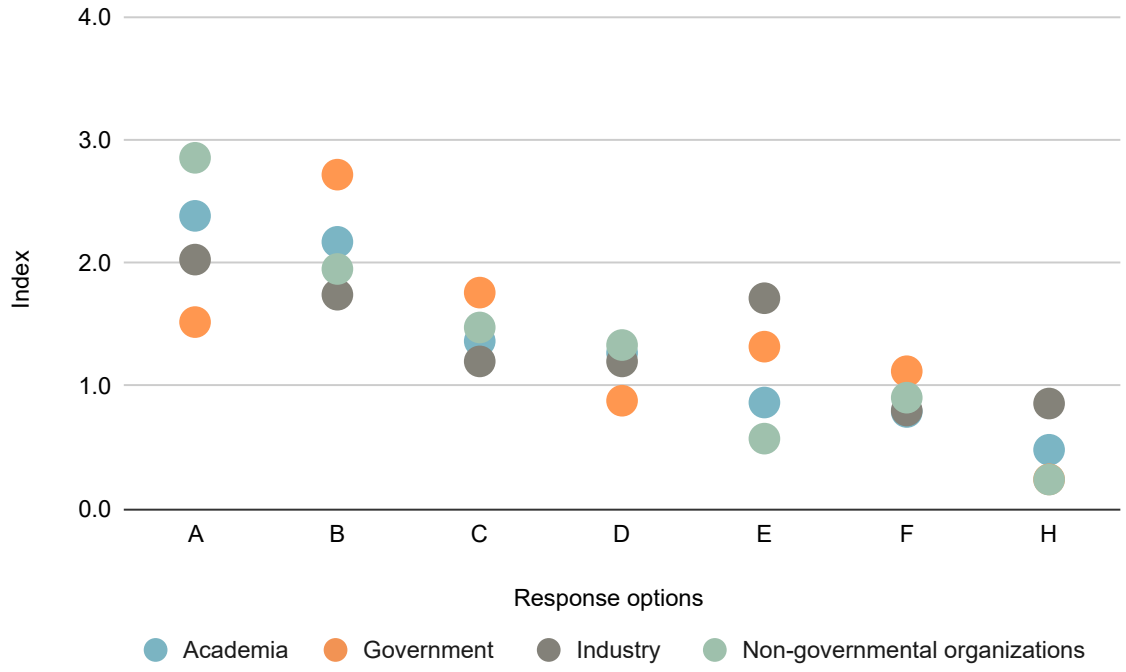
Table 17

Referencia	Opción
A	Improve the participation of local communities in the economic benefits of lithium mining.
B	Link lithium mining with the national economy and the scientific-technological system to build domestic capacities.
C	Improve the State's share of the economic rent from lithium mining.
D	Have human resources with the necessary skills to work in lithium mining.
E	Provide legal security and incentives for mining investment.
F	Produce lithium compounds at competitive costs and high quality standards.
H	Develop infrastructure for mining in salt flats (e.g., energy, transport).

Annex 2.
Results 1st Round

Main challenges for the economic sustainability of lithium mining in salt flats per membership group (Round 1) (*)

Figure 24.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

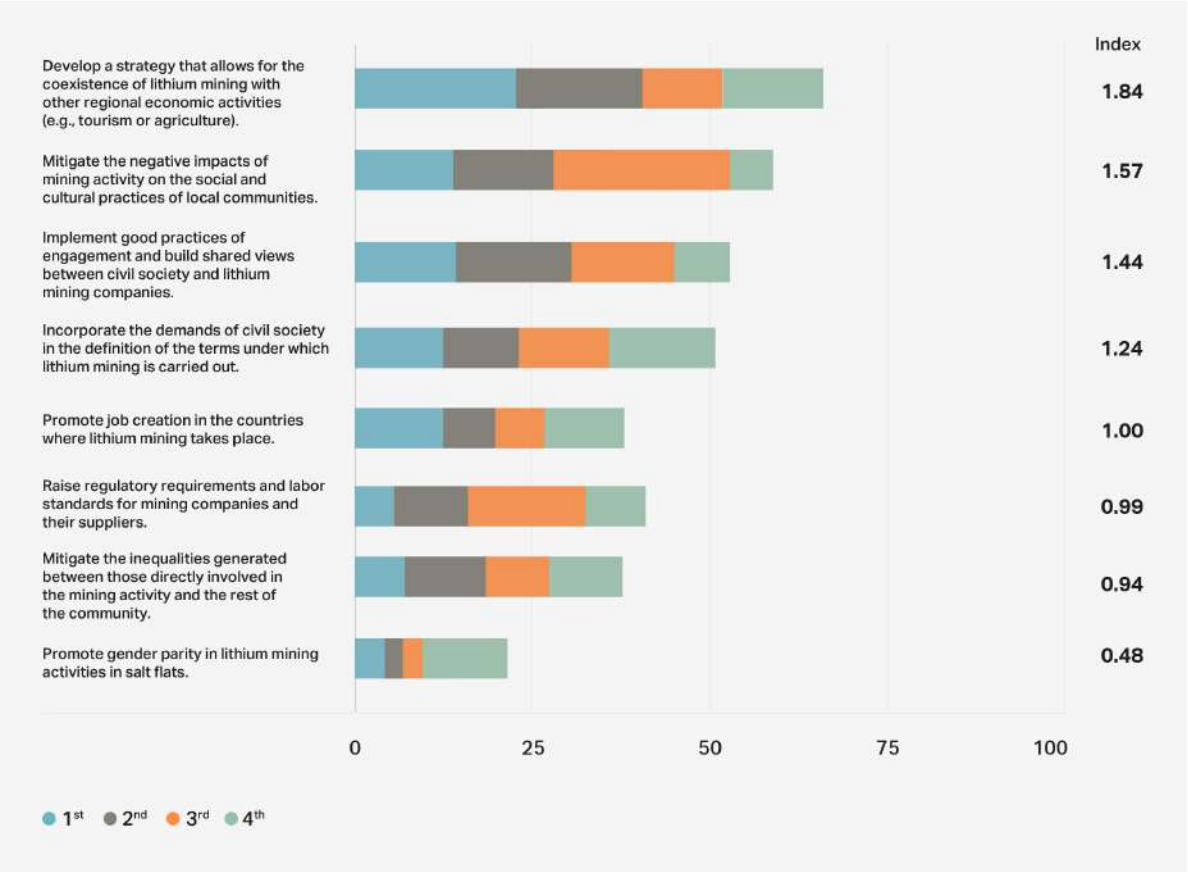
Annex 2.
Results 1st Round

Social sustainability

Main challenges for the social sustainability of lithium mining in salt flats (Round 1) (*)

Which of the following social sustainability challenges should be addressed as a priority? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

Figure 25.1

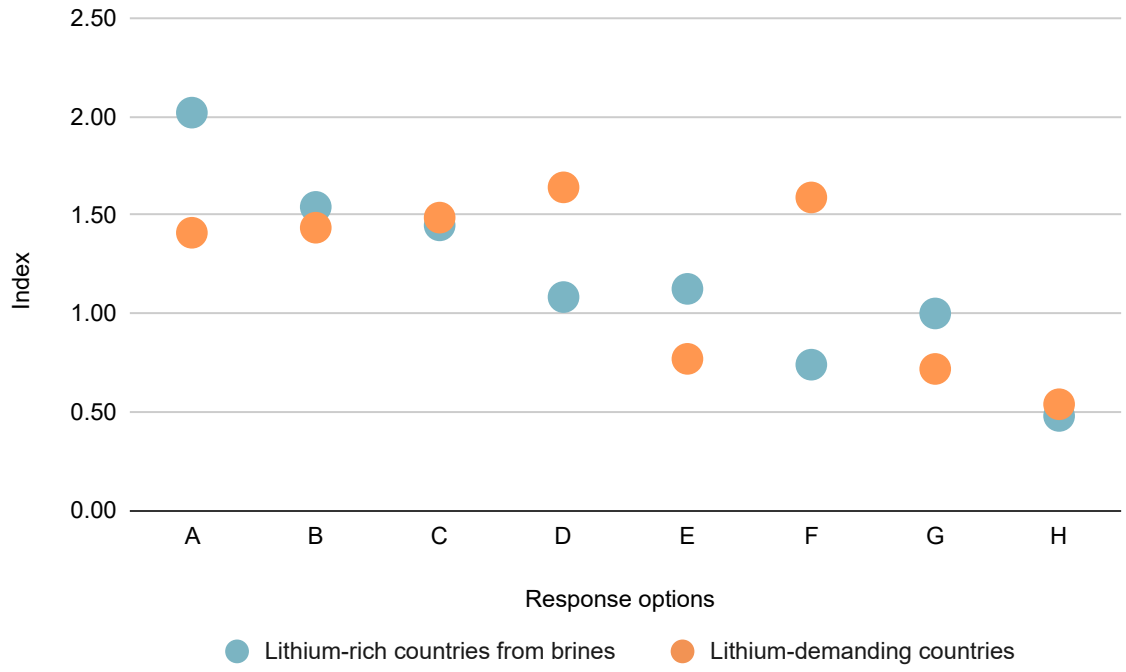


(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges. it was calculated assigning each response a value of 4 when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then calculated.

Annex 2.
Results 1st Round

Main challenges for the social sustainability of lithium mining in salt flats according to the country of residence of the panelists (Round 1) (*)

Figure 25.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

References. Response options for figures 25.2 and 25.3 (Round 1)

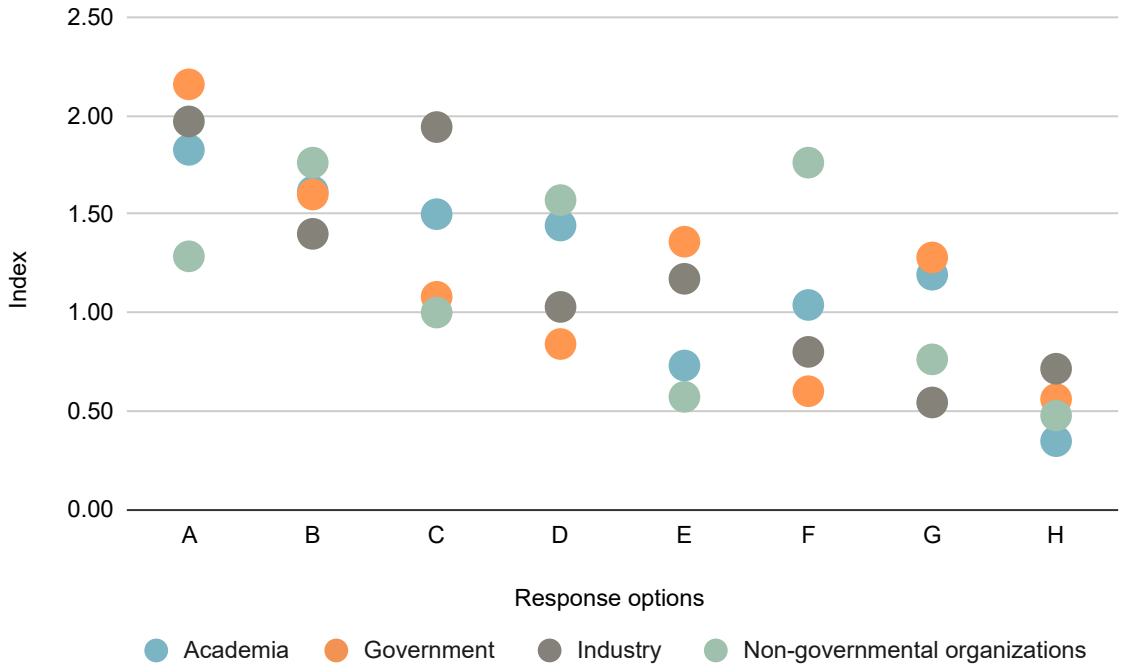
Table 18

Reference	Option
A	Develop a strategy that allows for the coexistence of lithium mining with other regional economic activities (e.g., tourism or agriculture).
B	Mitigate the negative impacts of mining activity on the social and cultural practices of local communities.
C	Implement good practices of engagement and build shared views between civil society and lithium mining companies.
D	Incorporate the demands of civil society in the definition of the terms under which lithium mining is carried out.
E	Promote job creation in the countries where lithium mining takes place.
F	Raise regulatory requirements and labor standards for mining companies and their suppliers.
G	Mitigate the inequalities generated between those directly involved in the mining activity and the rest of the community.
H	Promote gender parity in lithium mining activities in salt flats.

Annex 2.
Results 1st Round

Figure 25.3

Main challenges for the social sustainability of lithium mining in salt flats per membership group (Round 1) (*)



(*) Methodological note. The index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

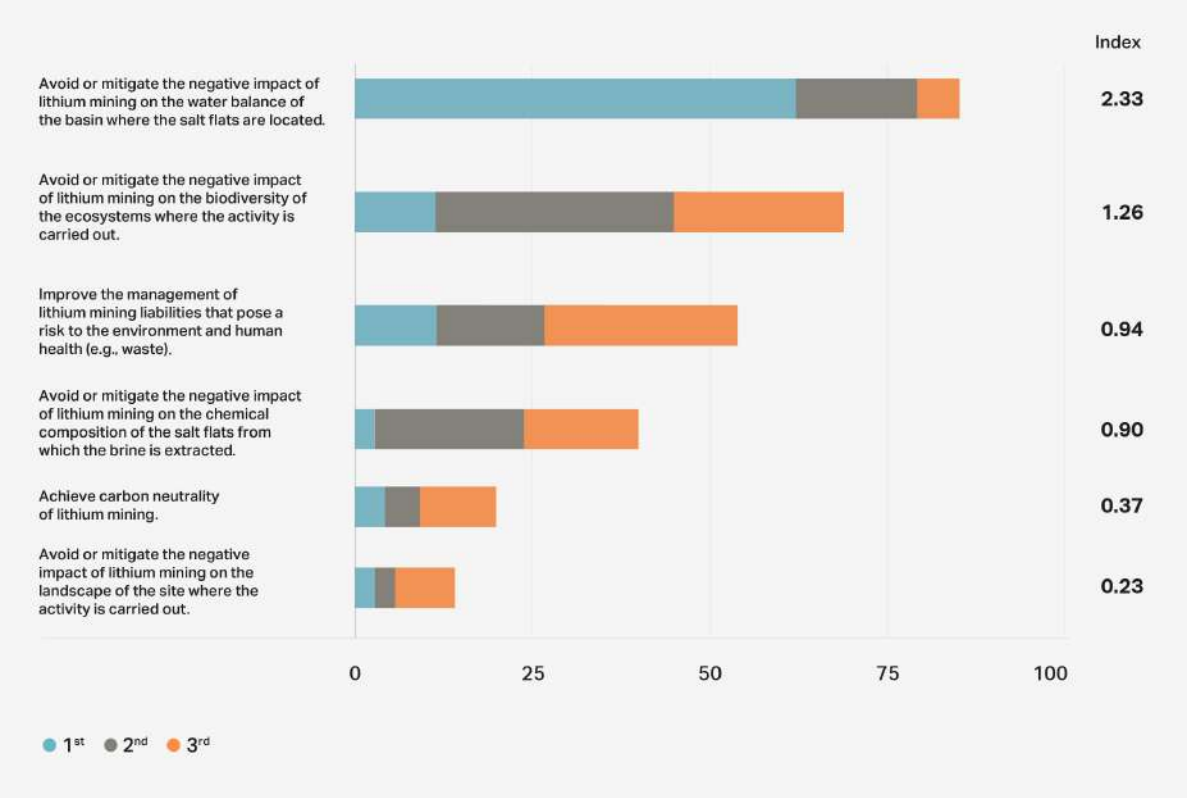
Annex 2.
Results 1st
Round

Environmental sustainability

Main challenges for the environmental sustainability of lithium mining in salt flats (Round 1) (*)

Which of the following environmental sustainability challenges should be addressed as a priority? Select the three most important ones, ranking them from 1 to 3 (being 1 the most important).

Figure 26.1



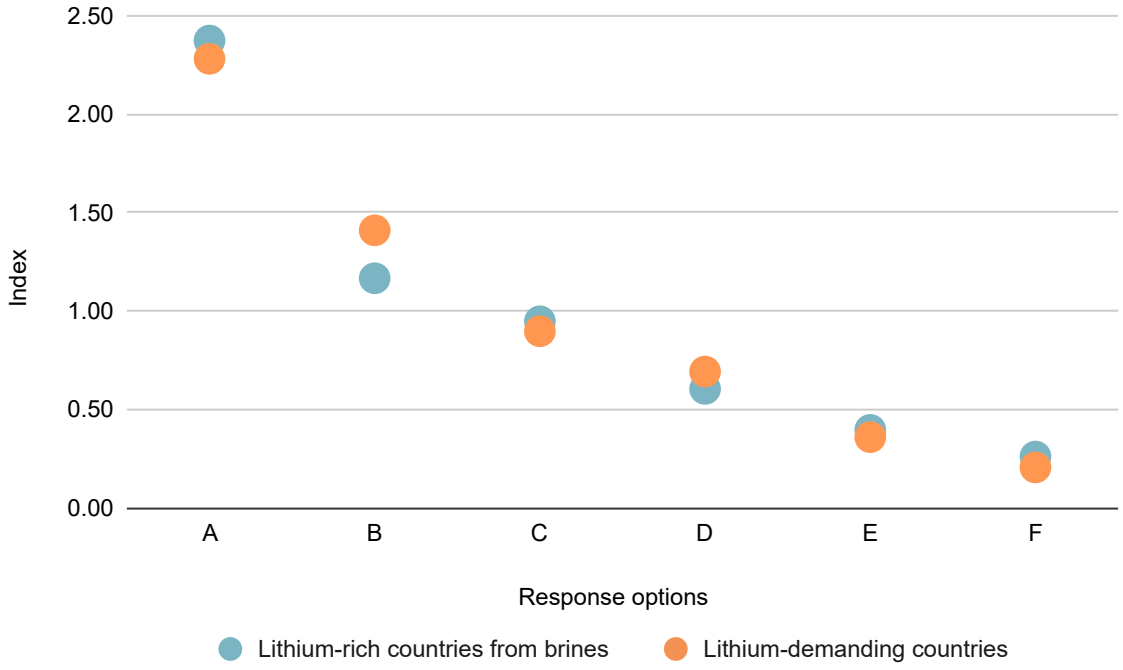
(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc). The index reported in the right column summarizes the information obtained and ranks the challenges. It was calculated assigning each response a value of 3 when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then calculated[8].

8 When presenting the results of this question in the 2nd Round questionnaire, the value for the category "Impact on the chemical composition of salt flats" was incorrectly reported. The value reported was 0.90, when the correct value is 0.66. In any case, this does not alter the category's ranking, which remains in fourth place.

Annex 2.
Results 1st Round

Main challenges for the environmental sustainability of lithium mining in salt flats according to the country of residence of the panelists (Round 1) (*)

Figure 26.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

References. Response options for figures 26.2 and 26.3 (Round 1)

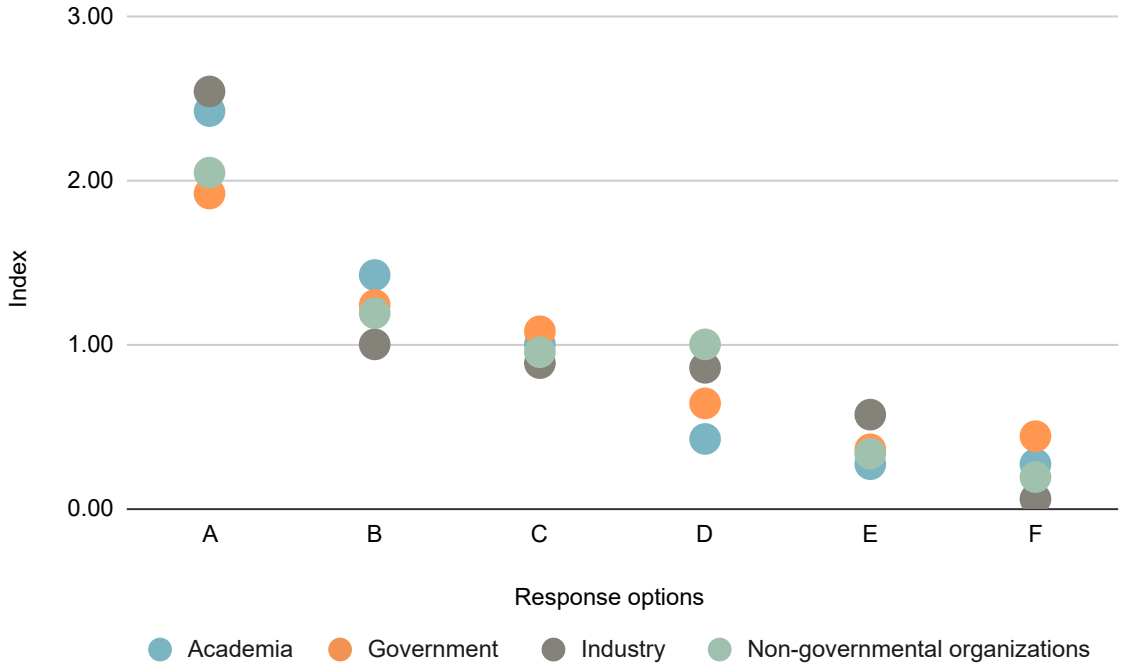
Table 19

Reference	Option
A	Avoid or mitigate the negative impact of lithium mining on the water balance of the basin where the salt flats are located.
B	Avoid or mitigate the negative impact of lithium mining on the biodiversity of the ecosystems where the activity is carried out.
C	Improve the management of lithium mining liabilities that pose a risk to the environment and human health (e.g., waste).
D	Avoid or mitigate the negative impact of lithium mining on the chemical composition of the salt flats from which the brine is extracted.
E	Achieve carbon neutrality of lithium mining.
F	Avoid or mitigate the negative impact of lithium mining on the landscape of the site where the activity is carried out.

Annex 2.
Results 1st
Round

Main challenges for the environmental sustainability of lithium mining in salt flats per membership group (Round 1) (*)

Figure 26.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

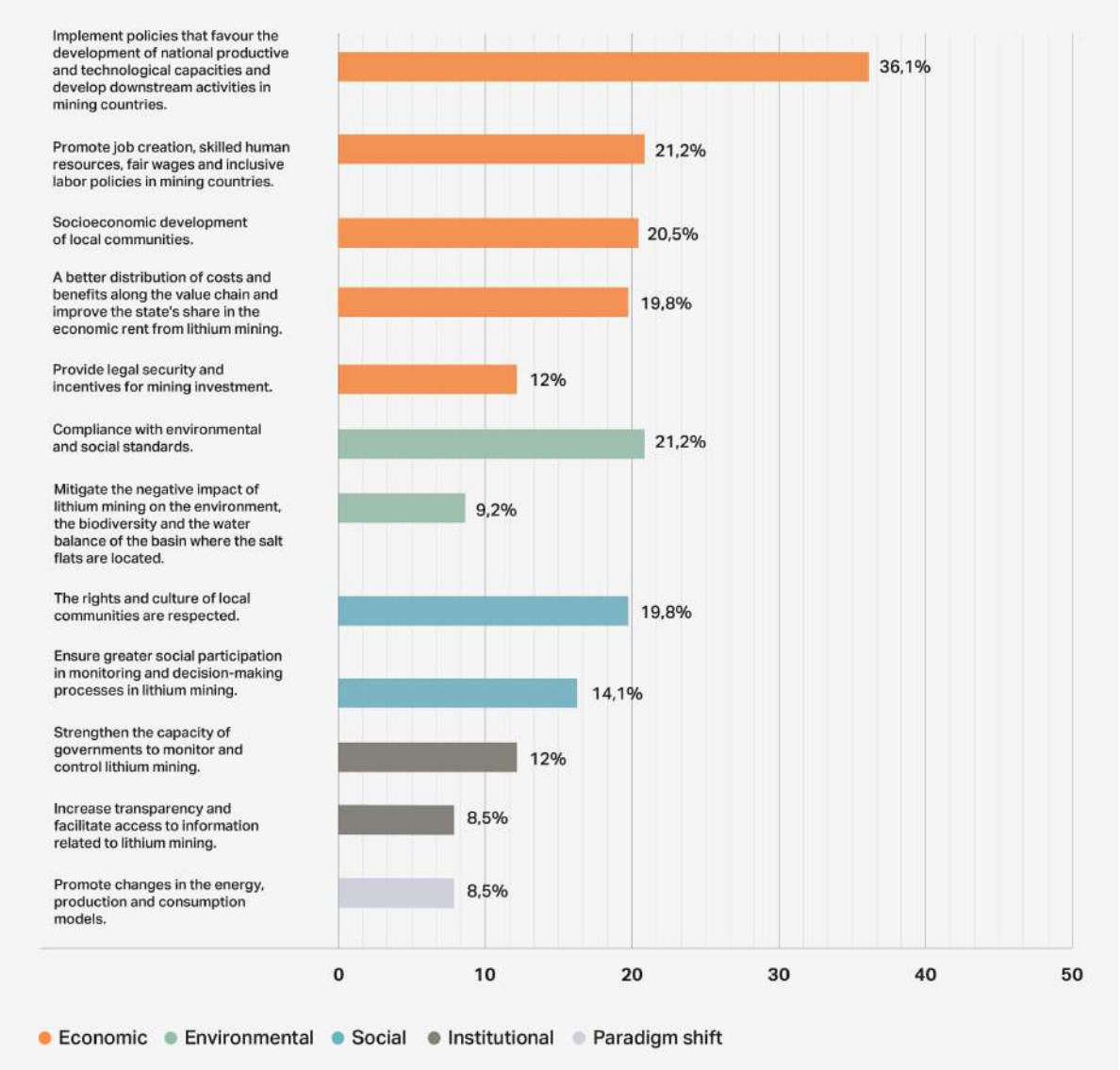
Annex 2.
Results 1st Round

A just lithium battery value chain

Conditions for a just lithium battery value chain (Round 1) (*)

Which are the most relevant conditions that the lithium battery value chain should satisfy to be considered just?

Figure 27



(*) Methodological note: On the left side of the graph, you can observe the categories derived from the coding process. The numbers at the end of each bar represent the percentage of the panel that included the respective category in their responses. Environmental challenges are represented by the green bars, while social, economic and institutional challenges are represented by the blue, orange and gray bars, and the answers that refer to a paradigm shift are represented by the light gray bar. It is important to note that the total percentage for each category exceeds 100% because participants were allowed to provide multiple answers. Categories with a participation rate of less than 5% in the aggregate responses of the panel are not reported.

Annex 2.
Results 1st Round

Conditions for a just lithium battery value chain (Round 1) (*)

Which of the following conditions should be promoted so that the lithium battery value chain becomes just? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

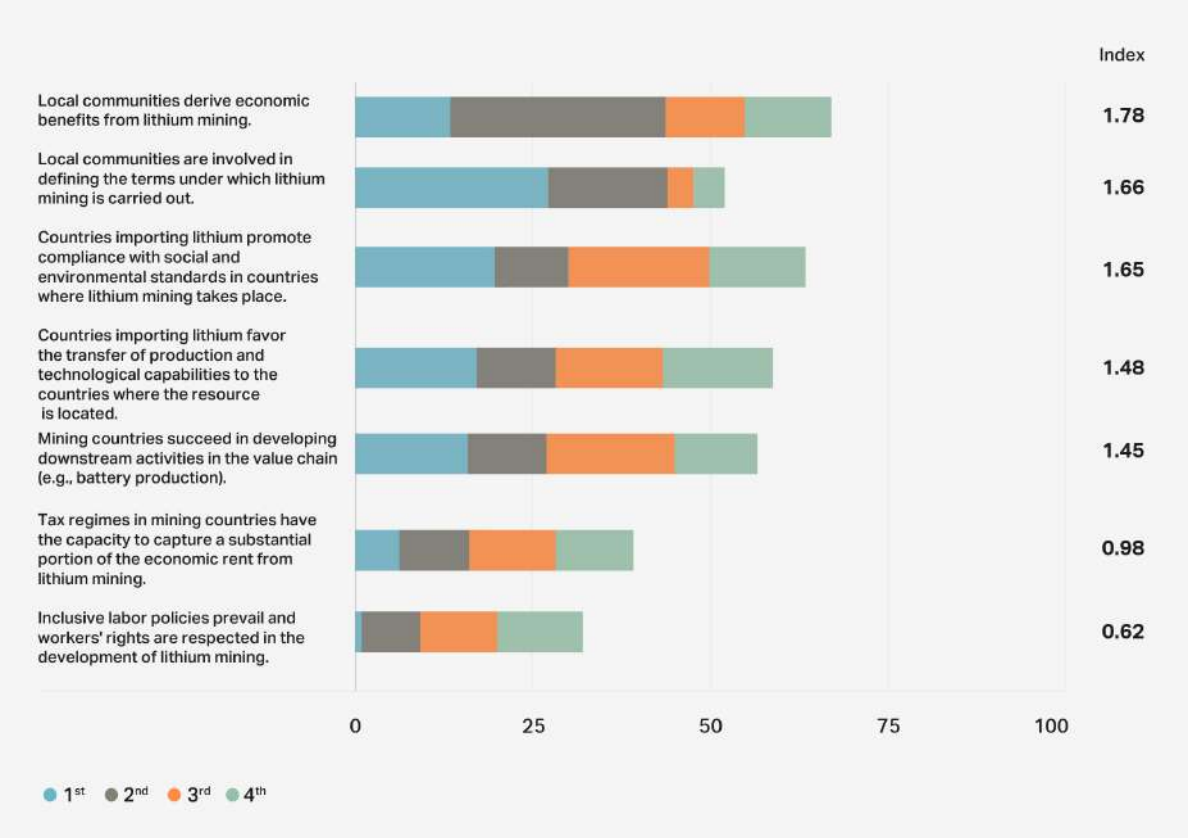


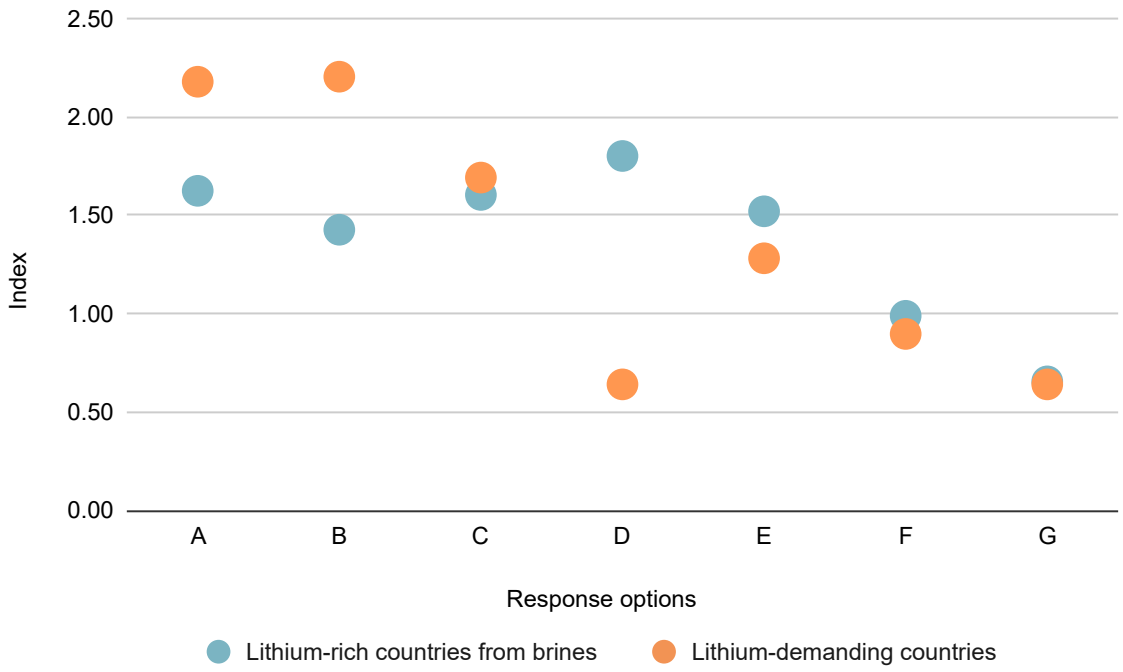
Figure 28.1

(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning each response a value of 4 when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained.

Annex 2.
Results 1st Round

Conditions for a just lithium battery value chain according to the country of residence of the panelists (Round 1) (*)

Figure 28.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

References. Response options for figures 28.2 and 28.3 (Round 1)

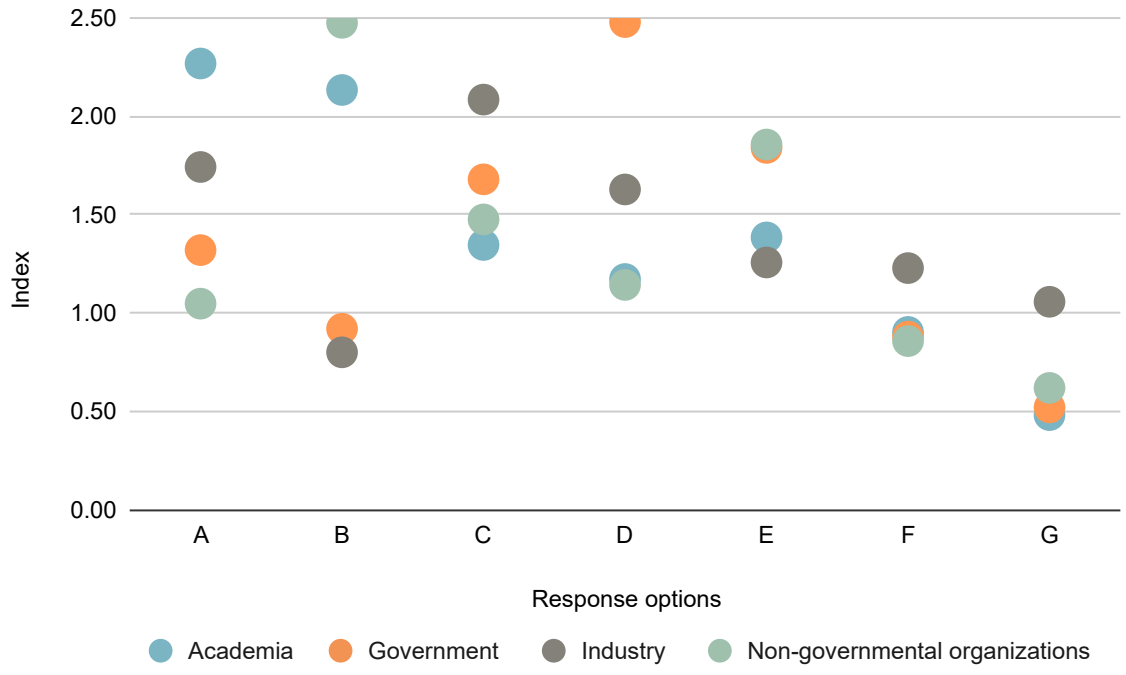
Table 20

Reference	Option
A	Local communities derive economic benefits from lithium mining.
B	Local communities are involved in defining the terms under which lithium mining is carried out.
C	Countries importing lithium promote compliance with social and environmental standards in countries where lithium mining takes place.
D	Countries importing lithium favor the transfer of production and technological capabilities to the countries where the resource is located.
E	Mining countries succeed in developing downstream activities in the value chain (e.g., battery production).
F	Tax regimes in mining countries have the capacity to capture a substantial portion of the economic rent from lithium mining.
G	Inclusive labor policies prevail and workers' rights are respected in the development of lithium mining.

Annex 2.
Results 1st Round

Conditions for a just lithium battery value chain per membership group (Round 1) (*)

Figure 28.3

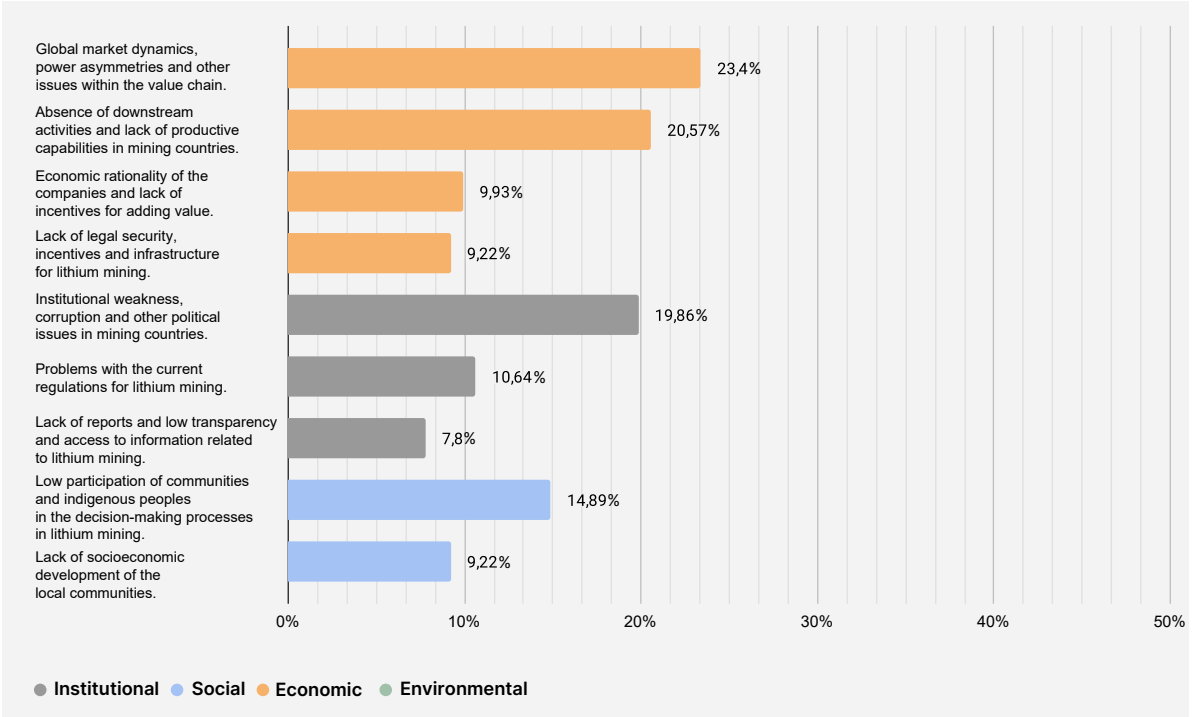


(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 4 to the response when the option was chosen first, 3 if it was chosen second, 2 if it was chosen third, 1 if it was chosen fourth, and 0 if it was not selected. A simple average of these values was then obtained. The red and blue dots represent the index value for each response option according to the respondent group.

Main obstacles for building a just lithium battery value chain (Round 1) (*)

Which is the main factor hindering the development of a just lithium battery value chain for the countries where lithium mining takes place? (open question)

Figure 29



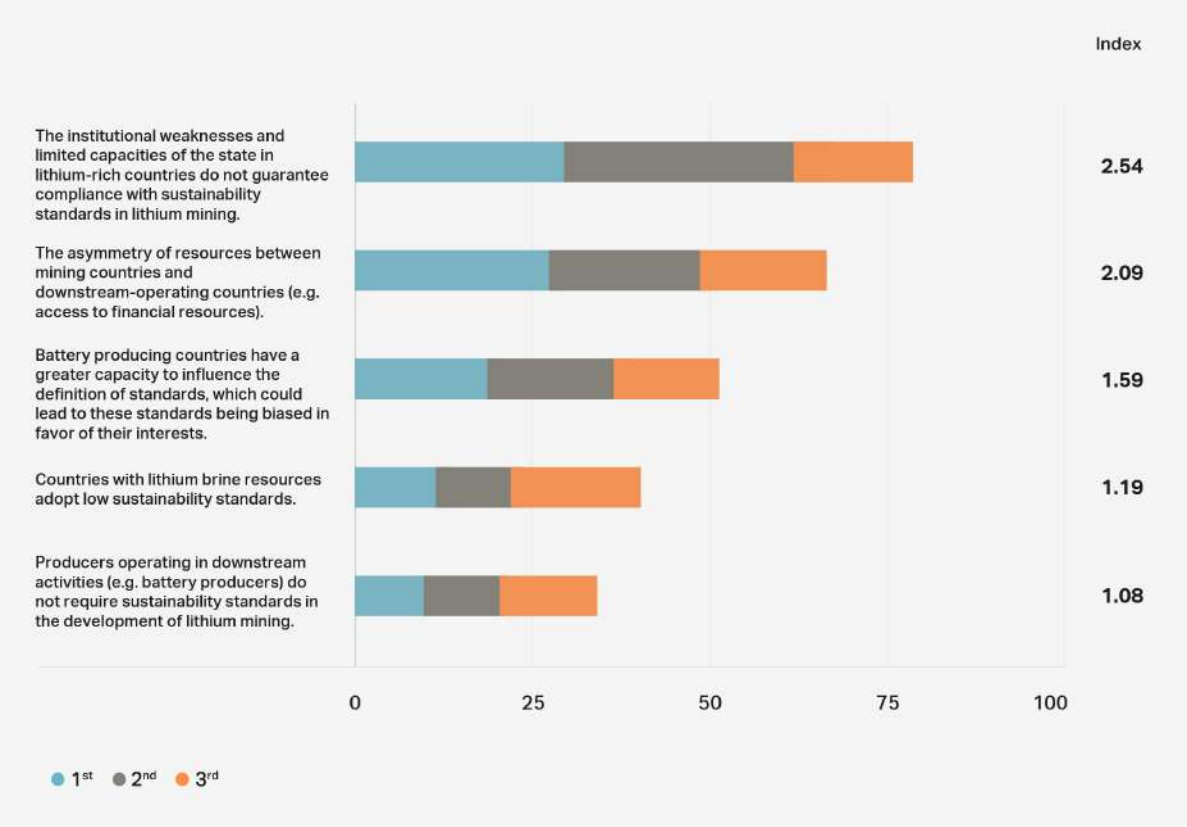
Annex 2.
Results 1st
Round

(*) Methodological note: On the left side of the graph, you can observe the categories derived from the coding process. The numbers at the end of each bar represent the percentage of the panel that included the respective category in their responses. Social, economic and institutional challenges are represented by the blue, orange and gray bars. It is important to note that the total percentage for each category exceeds 100% because participants were allowed to provide multiple answers. Categories with a participation rate of less than 5% in the aggregate responses of the panel are not reported.

Obstacles hindering the development of a just lithium battery value chain (Round 1) (*)

Which of the following obstacles are the most relevant in building a lithium battery value chain that is just for the countries where lithium mining takes place? Select the three most relevant and rank them from 1 to 3 (being 1 the most important).

Figure 30.1

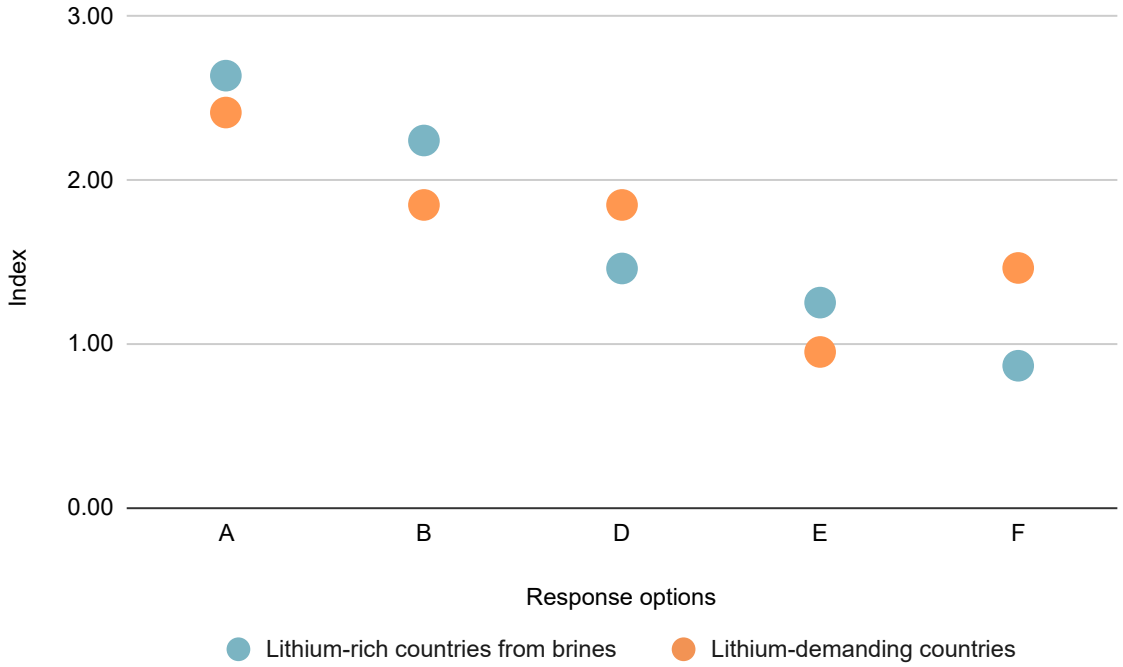


(*) Methodological note: The length of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The index reported in the right column summarizes the information obtained and ranks the challenges: it was calculated assigning each response a value of 3 when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained.

Annex 2.
Results 1st Round

Obstacles hindering the development of a just lithium battery value chain according to the country of residence of panelists (Round 1) (*)

Figure 30.2



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

References. Response options for figures 30.2 and 30.3 (Round 1)

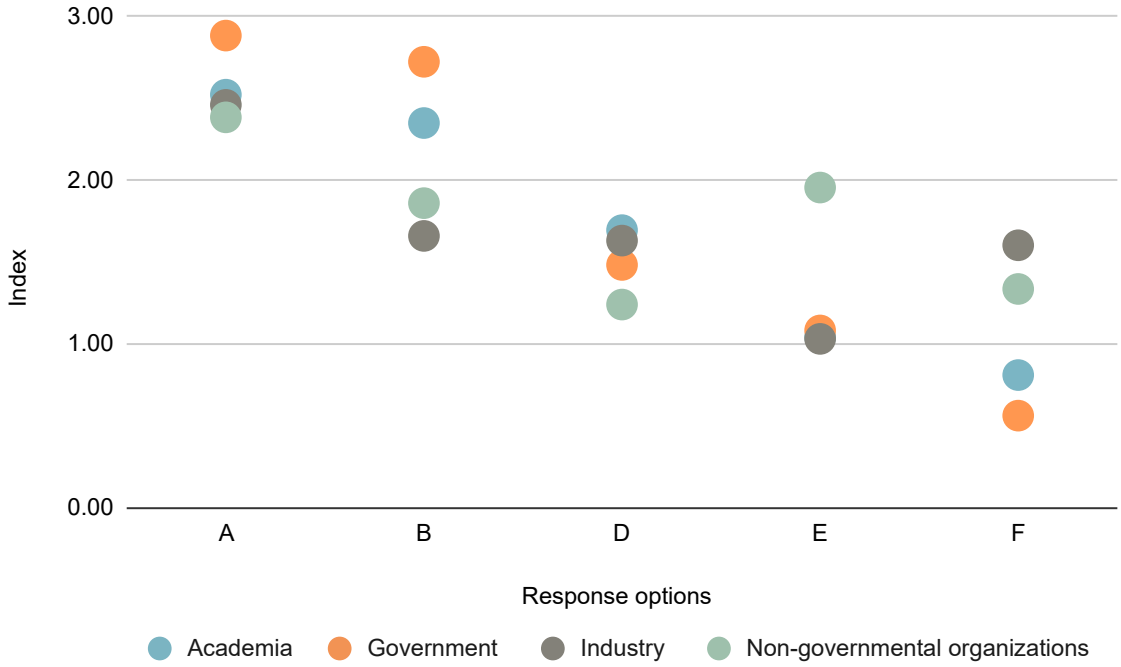
Table 21

Reference	Option
A	The institutional weaknesses and limited capacities of the state in lithium-rich countries do not guarantee compliance with sustainability standards in lithium mining
B	The asymmetry of resources between mining countries and downstream-operating countries (e.g. access to financial resources)
D	Battery producing countries have a greater capacity to influence the definition of standards, which could lead to these standards being biased in favor of their interests
E	Countries with lithium brine resources adopt low sustainability standards
F	Producers operating in downstream activities (e.g. battery producers) do not require sustainability standards in the development of lithium mining

Annex 2.
Results 1st Round

Obstacles hindering the development of a just lithium battery value chain per membership group (Round 1) (*)

Figure 30.3



(*) Methodological note: the index reported on the vertical axis summarizes the panelists' responses and ranks the challenges: it was calculated by assigning a value of 3 to the response when the option was chosen first, 2 if it was chosen second, 1 if it was chosen third, and 0 if it was not selected. A simple average of these values was then obtained. The colored dots represent the index value for each response option according to the respondent group.

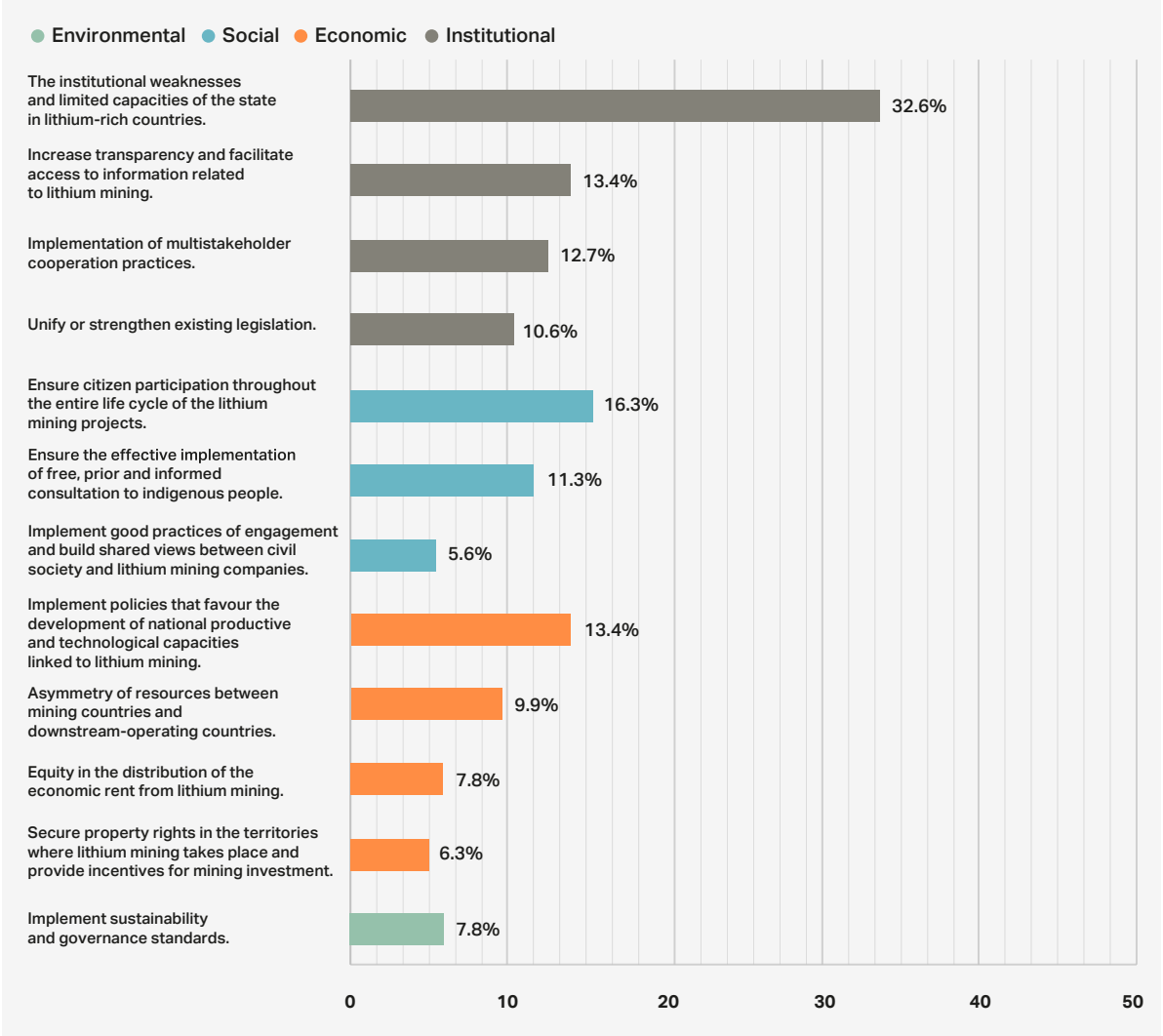
Annex 2.
Results 1st Round

Governance of lithium mining in salt flats

Main governance challenge affecting the sustainability of lithium mining in salt flats (Round 1) (*)

Which is the main governance challenge affecting the sustainability of lithium mining in salt flats? (open question).

Figure 31



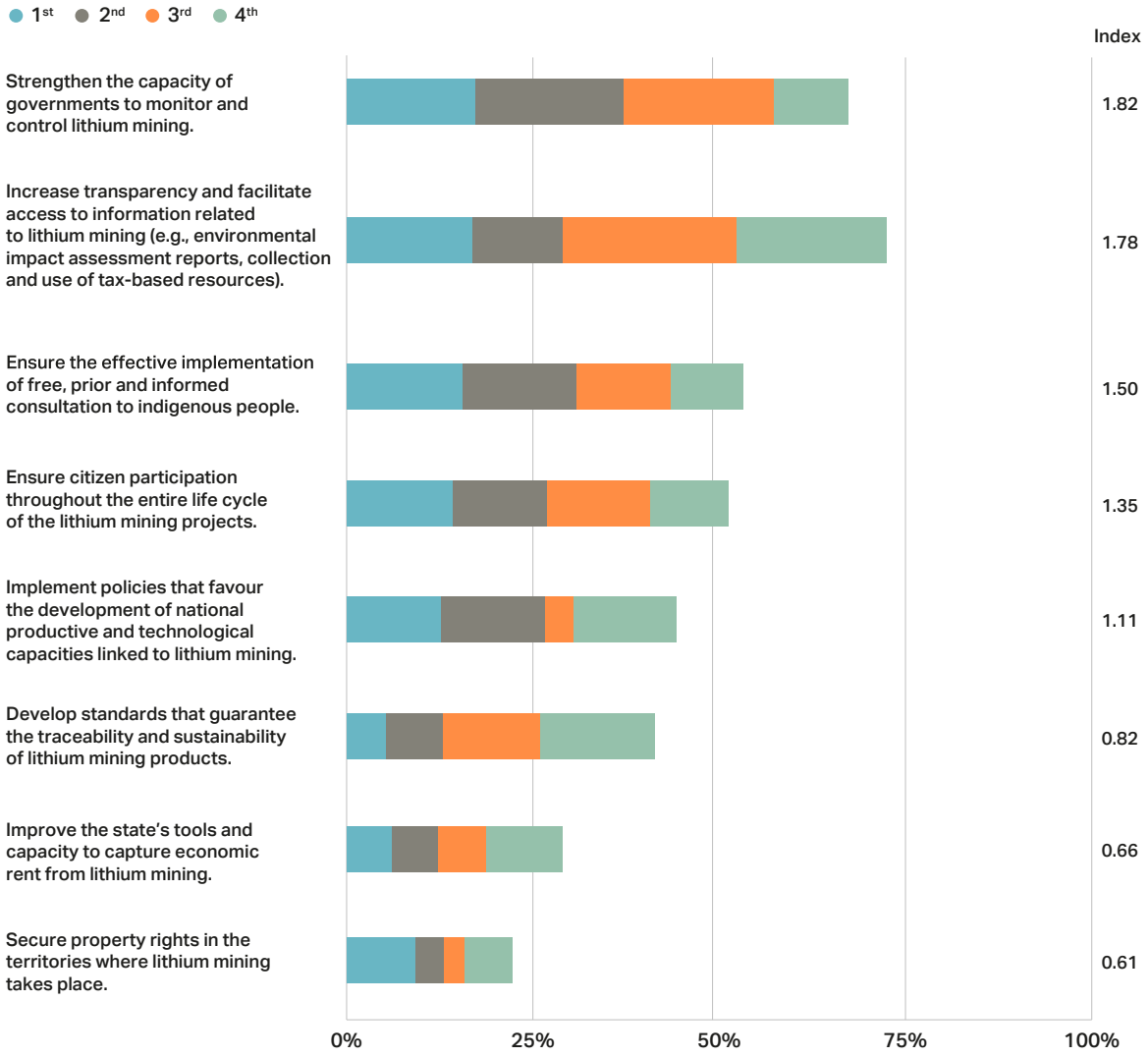
(*) Methodological note: On the left side of the graph, you can observe the categories derived from the coding process. The numbers at the end of each bar represent the percentage of the panel that included the respective category in their responses. Environmental challenges are represented by the green bars, while social, economic and institutional challenges are represented by the blue, orange and gray bars. It is important to note that the total percentage for each category exceeds 100% because participants were allowed to provide multiple answers. Categories with a participation rate of less than 5% in the aggregate responses of the panel are not reported.

Annex 2.
Results 1st Round

Challenges for the governance of lithium mining in salt flats (Round 1) (*)

Which of the following obstacles should be addressed as a priority? Select the four most important ones and rank them from 1 to 4 (1 is the most important).

Figure 32.1

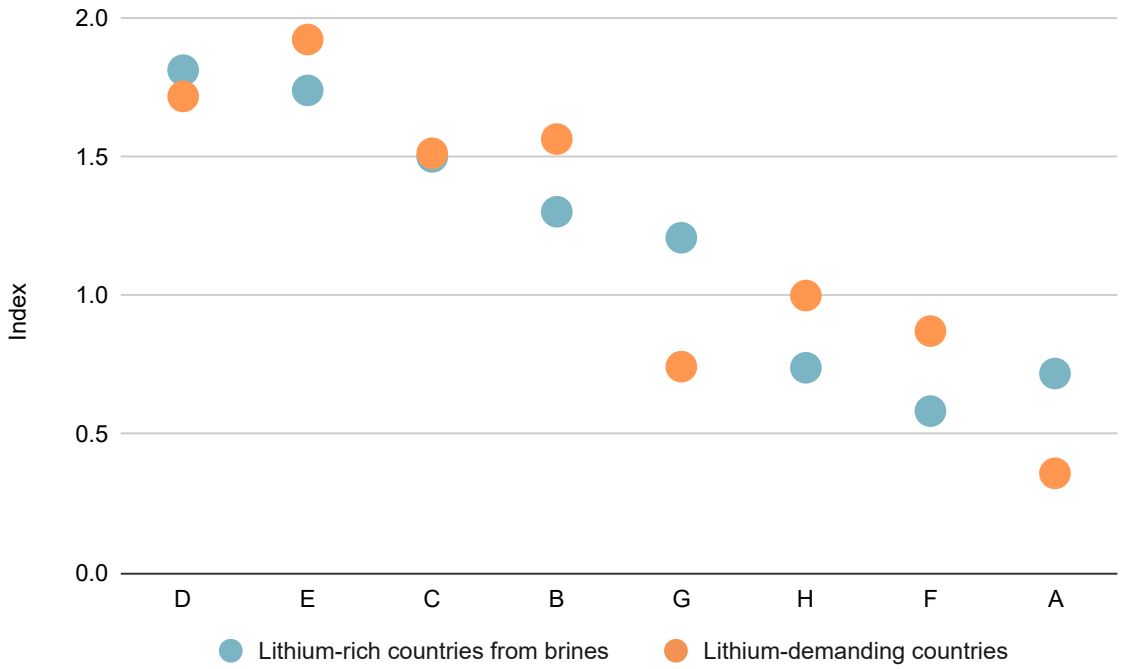


(*) Methodological note: the spread of the bar indicates what percentage of the panel mentioned that challenge. The color code reports the order in which it was mentioned (first, second, etc.). The reported index in the right column summarizes the information obtained and ranks the challenges: it was calculated by assigning to the answer a value of 4 when the option was chosen first, 3 if it was second-elected, 2 if third-elected, 1 if fourth-elected, and 0 if unelected. Then a simple average of these values was calculated.

Annex 2.
Results 1st Round

Challenges for the governance of lithium mining in salt flats according to the country of residence of panelists (Round 1)

Figure 32.2



References. Response options for figures 32.2 and 32.3 (Round 1)

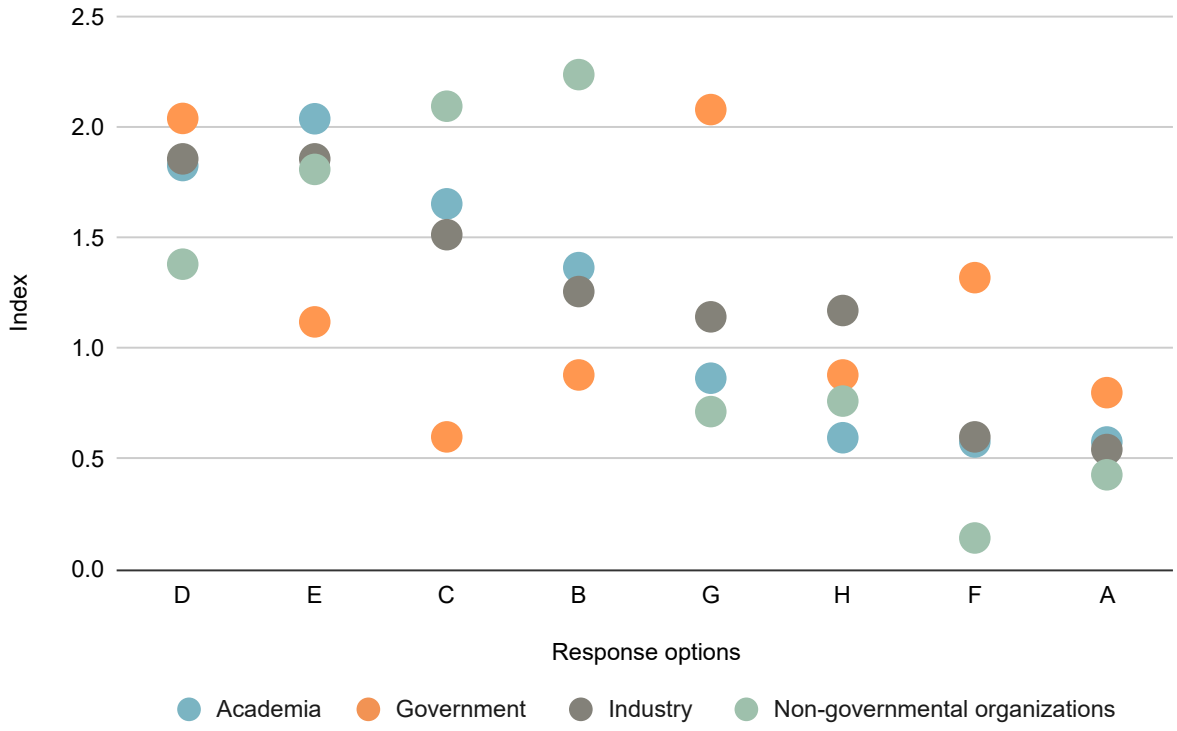
Table 22

Referencia	Opción
D	Strengthen the capacity of governments to monitor and control lithium mining.
E	Increase transparency and facilitate access to information related to lithium mining (e.g., environmental impact assessment reports, collection and use of tax-based resources).
C	Ensure the effective implementation of free, prior and informed consultation to indigenous people.
B	Ensure citizen participation throughout the entire life cycle of the lithium mining projects.
G	Implement policies that favour the development of national productive and technological capacities linked to lithium mining.
H	Develop standards that guarantee the traceability and sustainability of lithium mining products.
F	Improve the state's tools and capacity to capture economic rent from lithium mining.
A	Secure property rights in the territories where lithium mining takes place.

Annex 2.
Results 1st Round

Challenges for the governance of lithium mining in salt flats per membership group (Round 1)

Figure 32.3



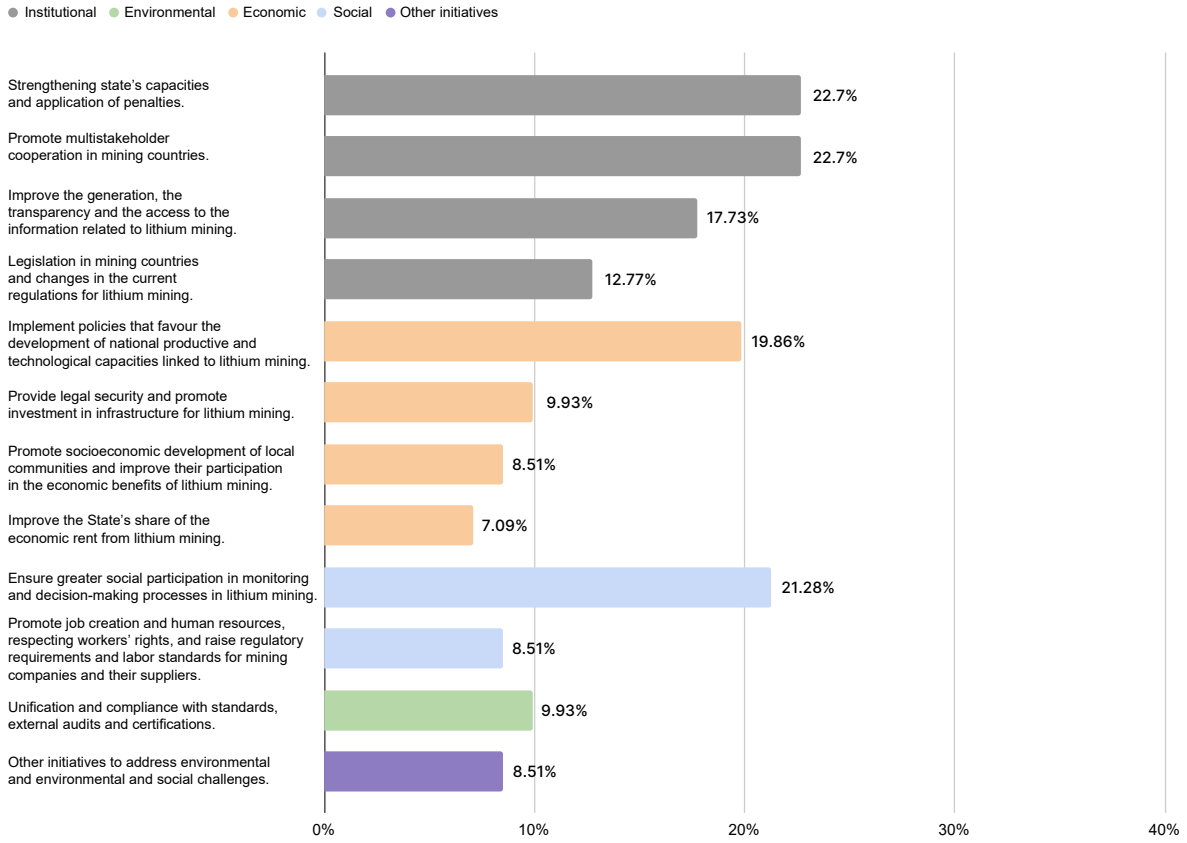
Annex 2.
Results 1st Round

Initiatives and instruments for justice and sustainability

Initiatives or policy tools that would be most effective in promoting a just value chain for lithium-rich countries from brine (Round 1) (*)

Which initiatives or policy tools would be most effective in promoting a lithium battery value chain that is just for the countries where lithium mining takes place?

Figure 33



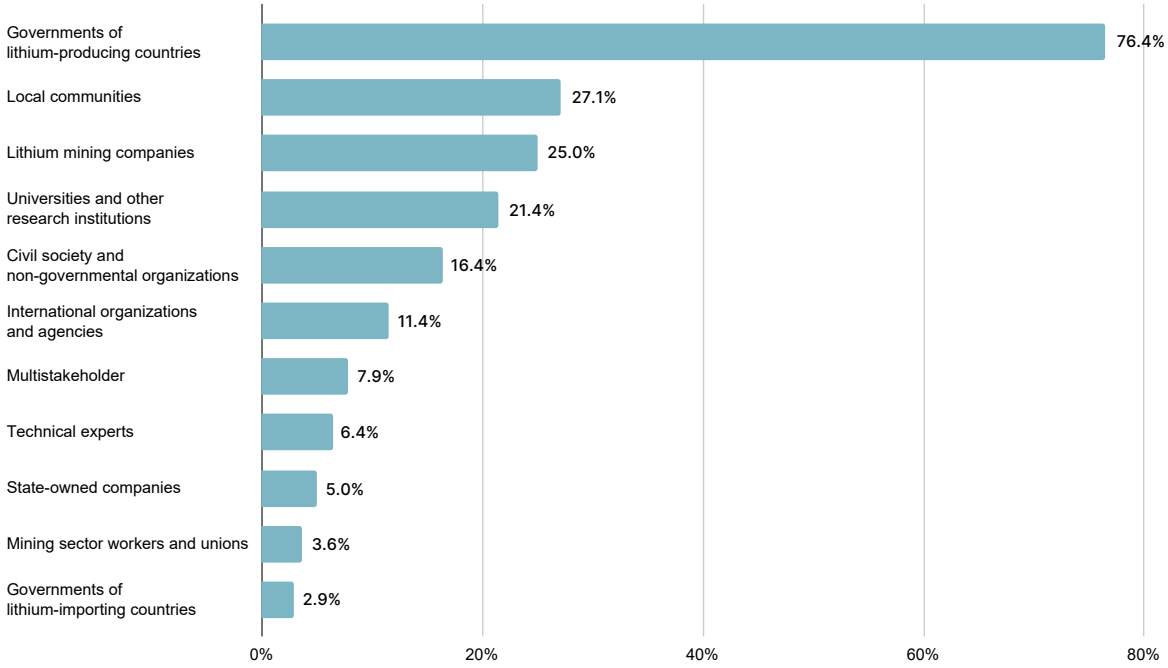
(*) Methodological note: On the left side of the graph, you can observe the categories derived from the coding process. The numbers at the end of each bar represent the percentage of the panel that included the respective category in their responses. Environmental challenges are represented by the green bars, while social, economic and institutional challenges are represented by the blue, orange and gray bars, and the answers that refer to other initiatives to address social and environmental challenges are represented by the purple bar. It is important to note that the total percentage for each category exceeds 100% because participants were allowed to provide multiple answers. Categories with a participation rate of less than 5% in the aggregate responses of the panel are not reported.

Annex 2.
Results 1st Round

A just value chain for lithium-rich countries from brine. Actors that should play a key role in promoting the most effective initiatives (Round 1)

Which actor(s) should be in charge of promoting these initiatives or policy tools? (open question).

Figure 34



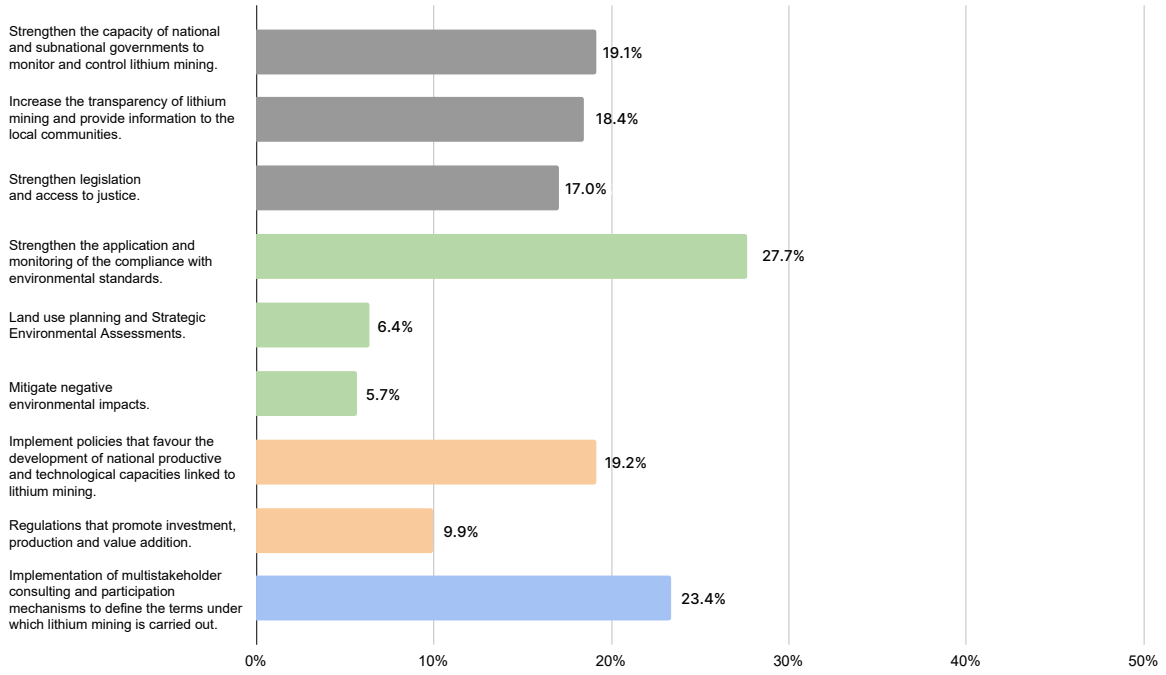
(*) Methodological note: On the left side of the graph, you can observe the categories derived from the coding process. The numbers at the end of each bar represent the percentage of the panel that included the respective category in their responses. It is important to note that the total percentage for each category exceeds 100% because participants were allowed to provide multiple answers.

Annex 2.
Results 1st Round

Initiatives or policy tools that would be most effective in addressing the sustainability challenges in lithium mining (Round 1)

Which initiatives or policy tools would be most effective in addressing the main sustainability challenges faced by lithium mining? (open question).

Figure 35

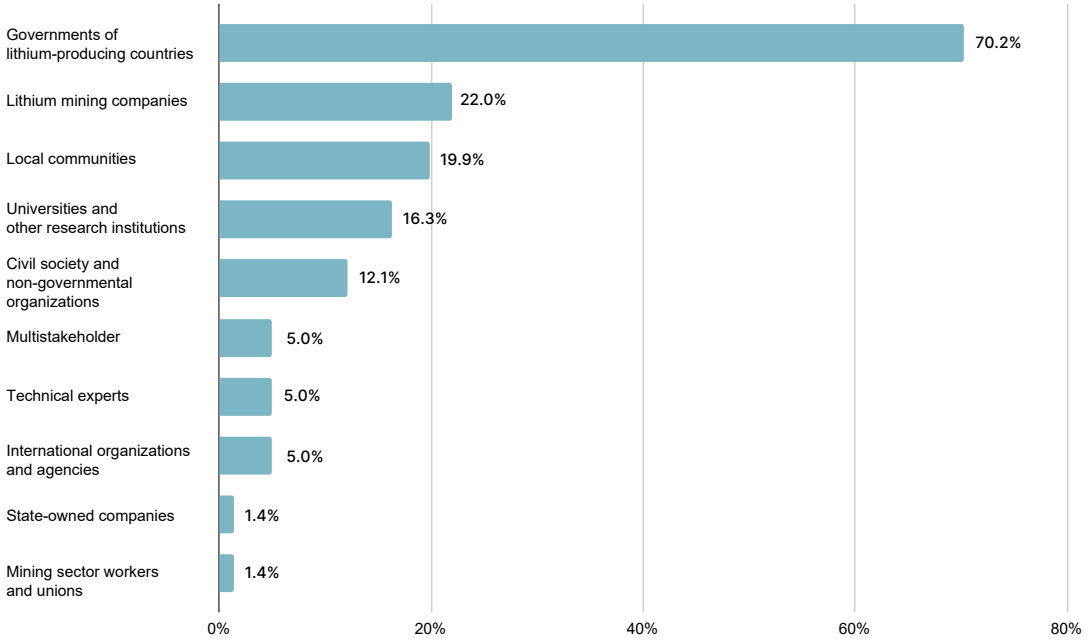


(*) Methodological note: On the left side of the graph, you can observe the categories derived from the coding process. The numbers at the end of each bar represent the percentage of the panel that included the respective category in their responses. Environmental challenges are represented by the green bars, while social, economic and institutional challenges are represented by the blue, orange and gray bars. It is important to note that the total percentage for each category exceeds 100% because participants were allowed to provide multiple answers.

Sustainability of lithium mining. Actors that should play a key role in promoting the most effective initiatives (Round 1)

Which actor(s) should be in charge of promoting these initiatives or policy tools? (open question).

Figure 36



Annex 2.
Results 1st Round

(*) Methodological note: On the left side of the graph, you can observe the categories derived from the coding process. The numbers at the end of each bar represent the percentage of the panel that included the respective category in their responses. It is important to note that the total percentage for each category exceeds 100% because participants were allowed to provide multiple answers.

Annex III.
Questionnaires
1st and 2nd Round

Annex 3. Questionnaires of 1st and 2nd Round

Green Dealings

A just and sustainable lithium battery value chain

Welcome!

Thank you for your interest in participating in this first round of the Delphi survey of the project "Green dealings: lithium-ion battery negotiations between South America and Europe for a just energy transition".

Based on your experience and knowledge, we ask you to answer some questions related to the sustainability of the lithium-ion battery value chain. The estimated time to complete the survey is **15 minutes**.

We invite you to share this link with a colleague who, because of his or her knowledge of the sector, could be interested in answering the survey: https://es.surveymonkey.com/r/K7BBPXC?lang=en.

Your answers will be processed for statistical purposes, respecting anonymity and confidentiality. Please enter your e-mail address below. This will allow you to resume completing the survey at any time. The survey must be completed by **September 18**, 2022.

Once the study is completed, you will be invited to a virtual meeting to discuss the results, anonymized and aggregated from all responses. In this way, the participants in the Delphi survey have the opportunity to validate the results, as well as to benefit immediately from seeing how perspectives on the challenges facing the battery value chain differ across the sector.

E-mail

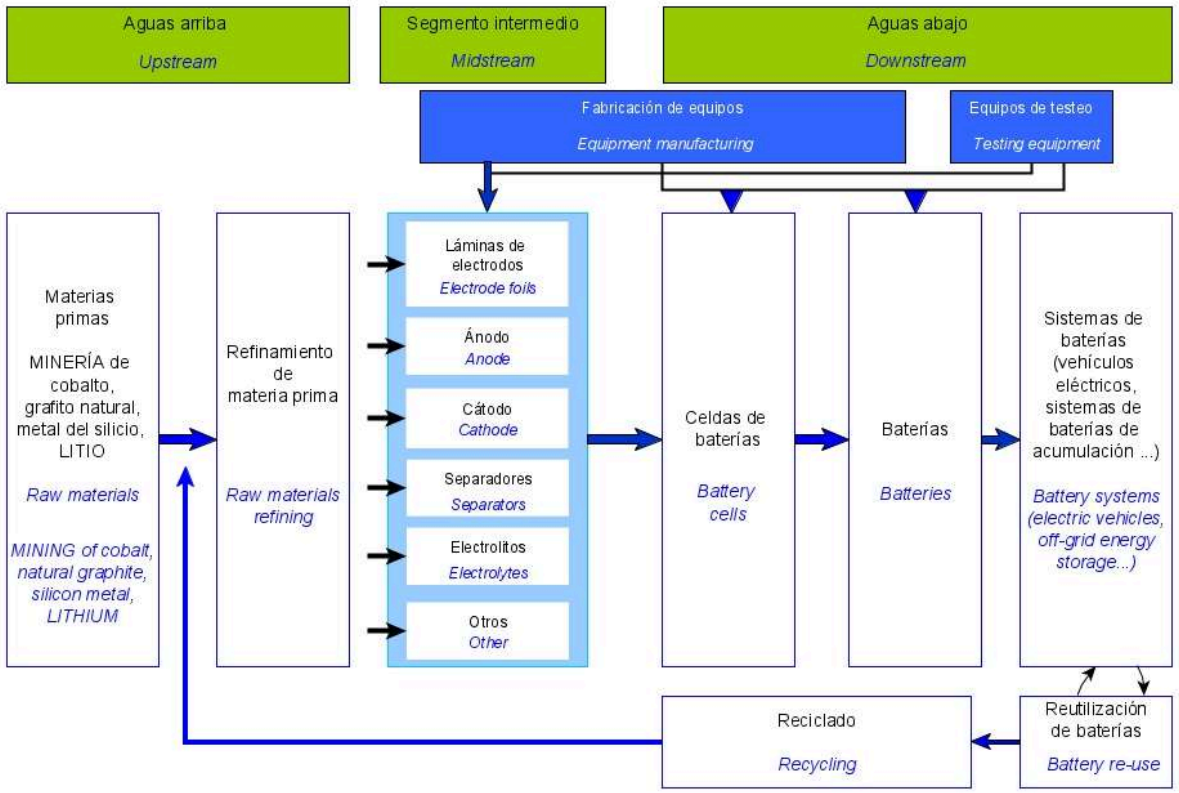
A just and sustainable lithium battery value chain

THE LITHIUM BATTERY VALUE CHAIN

The term "value chain" is used to refer to the set of activities linked to the production of lithium batteries, from the extraction of lithium-rich brine to battery recycling, including battery cell production and electric vehicle production.

Below, we present a figure including the main activities involved in the lithium battery value chain. "Upstream" activities correspond to the extraction and

processing of raw materials, while “downstream” activities correspond to the raw materials processing for the production of intermediate, final and recycled goods.



A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

The energy transition is metal-intensive. The expansion of the battery industry will demand more lithium. This can affect the sustainability of areas with abundant lithium reserves. Below, we will ask you about the sustainability challenges faced by lithium mining in salt flats.

1. Based on your experience and knowledge of the activity and the territory, you would say that lithium mining in salt flats has…

- ☐ …no significant sustainability problems.
- ☐ …some specific sustainability problems.
- ☐ …several relevant sustainability problems.
- ☐ …very significant sustainability problems.

A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

2. Considering your last answer, select from below the course of action that seems most appropriate to you.

- ☐ Priority should be given to ensuring the expansion of lithium supply, irrespective of any sustainability issues that may exist.
- ☐ Sustainability issues need to be resolved progressively, so as not to interfere with the pace of expansion of lithium mining.
- ☐ Measures should be taken to avoid and, when not possible, mitigate sustainability problems, even if this means slowing down the pace of the expansion of lithium mining.
- ☐ Priority should be given to resolving sustainability issues, even if this means suspending the mining activity.

A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

3. Which are the main SUSTAINABILITY CHALLENGES of lithium mining in salt flats? (max. 1500 characters)

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SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

A classical view of sustainable development identifies three main elements: economic growth, social inclusion and environmental protection. Next, we will ask you some questions regarding the sustainability challenges faced by lithium mining in salt flats, in its economic, social and environmental dimensions.

4. Which of the following ECONOMIC SUSTAINABILITY CHALLENGES should be addressed as a priority? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

	1	2	3	4
Provide legal security and incentives for mining investment.	○	○	○	○
Improve the participation of local communities in the economic benefits of lithium mining.	○	○	○	○
Improve the state's share of the economic rent from lithium mining.	○	○	○	○
Develop infrastructure for lithium mining in salt flats (e.g. energy, transport).	○	○	○	○
Produce lithium compounds at competitive costs and high quality standards.	○	○	○	○
Have human resources with the necessary skills to work on lithium mining.	○	○	○	○
Link lithium mining with the national economy and the scientific-technological system to build domestic capacities.	○	○	○	○

A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

5. Which of the following SOCIAL SUSTAINABILITY CHALLENGES should be addressed as a priority? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

	1	2	3	4
Promote job creation in the countries where lithium mining takes place.	○	○	○	○
Raise regulatory requirements and labour standards for mining companies and their suppliers.	○	○	○	○
Develop a strategy that allows for the coexistence of lithium mining with other regional economic activities (e.g. tourism or agriculture).	○	○	○	○
Mitigate the inequalities generated between those directly involved in lithium mining activities and the rest of the community.	○	○	○	○
Mitigate the negative impacts of the mining activity on social and cultural practices of local communities.	○	○	○	○
Implement good practices of engagement and build shared visions between civil society and lithium mining companies.	○	○	○	○
Take into account civil society demands in the process of defining the terms under which lithium mining is carried out.	○	○	○	○
Promote gender parity in lithium mining activities in salt flats.	○	○	○	○

A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

6. Which of the following ENVIRONMENTAL SUSTAINABILITY CHALLENGES should be addressed as a priority? Select the three most important ones, ranking them from 1 to 3 (being 1 the most

important).

	1	2	3	4
Achieve carbon neutrality of lithium mining.	○	○	○	○
Avoid or mitigate the negative impact of lithium mining on the water balance of the basin where the salt flats are located.	○	○	○	○
Avoid or mitigate the negative impact of lithium mining on the chemical composition of the salt flats from which the brine is extracted.	○	○	○	○
Avoid or mitigate the negative impact of lithium mining on the biodiversity of the ecosystems where the activity is carried out.	○	○	○	○
Avoid or mitigate the negative impact of lithium mining on the landscape of the site where the activity is carried out.	○	○	○	○
Improve the management of lithium mining liabilities that pose a risk to the environment and human health (e.g. waste).	○	○	○	○

A just and sustainable lithium battery value chain

SECTION 2. A JUST LITHIUM BATTERY VALUE CHAIN

According to different sources, the costs and benefits of the processes involved in the energy transition are unevenly distributed across countries, economic activities and the stakeholders involved. This has given rise to the concept of “just transition”.

In this section, we ask you to mention the fundamental features needed for the lithium battery value chain to be just for the countries where lithium mining takes place, and additionally mention the main challenges for achieving this goal.

7. Which are the most relevant CONDITIONS that the lithium battery value chain should satisfy to be considered JUST? (max. 1500 characters).

A just and sustainable lithium battery value chain

SECTION 2. A JUST LITHIUM BATTERY VALUE CHAIN

8. Which of the following CONDITIONS should be promoted so that the lithium battery value chain becomes JUST? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

	1	2	3	4
Local communities are involved in defining the terms under which lithium mining is carried out.	☑	○	○	○
Local communities, receive economic benefits from lithium mining.	○	○	○	○
Inclusive labour policies that promote respect for diversity prevail in lithium mining.	○	○	○	○
Tax regimes in mining countries have the capacity to capture a substantial portion of the economic rent from lithium mining.	○	○	○	○
Mining countries succeed in developing downstream activities in the value chain (e.g., battery production).	○	○	○	○
Countries importing lithium promote compliance with social and environmental standards in countries where lithium mining takes place.	○	○	○	○
Countries importing lithium favour the transfer of productive capabilities and technology to the countries where the resource is located.	○	○	○	○

A just and sustainable lithium battery value chain

SECTION 2. A JUST LITHIUM BATTERY VALUE CHAIN

9. Which is the main factor HINDERING the development of a JUST lithium battery value chain for the countries where lithium mining takes place?

A just and sustainable lithium battery value chain

SECTION 2. A JUST LITHIUM BATTERY VALUE CHAIN

10. Which of the following OBSTACLES are the most relevant in building a lithium battery value chain that is JUST for the countries where lithium mining takes place? Select the three most relevant and rank them from 1 to 3 (being 1 the most important).

	1	2	3
Countries with lithium brine resources adopt low sustainability standards.	○	○	○
The institutional weakness and limited capabilities of the state in lithium-rich countries do not guarantee compliance with sustainability standards in lithium mining.	○	○	○
Producers operating in downstream activities (e.g. battery producers) do not require sustainability standards for the development of lithium mining.	○	○	○
The asymmetry of resources between mining countries and downstream-operating countries (e.g. access to financial resources).	○	○	○
Battery producing countries have a greater capacity to influence the definition of standards, which could lead to those standards being biased in favour of their interests.	○	○	○

A just and sustainable lithium battery value chain

SECTION 3. GOVERNANCE OF LITHIUM MINING IN SALT

FLATS

The concept of governance refers to the decision-making processes related to natural resource management. Such processes require interactions and negotiations among stakeholders and encompass different dimensions including, e.g., ownership, extraction, monitoring and conservation of resources, as well as the capture and distribution of the economic rent. Next, we are going to ask you some questions regarding the challenges faced by the governance of lithium mining in salt flats to favour the sustainability of the activity. In the following rounds of the survey we will delve into policy initiatives and instruments to address the identified challenges.

11. Which is the main GOVERNANCE CHALLENGE affecting the SUSTAINABILITY of lithium mining on salt flats? (max. 1000 characters).

A just and sustainable lithium battery value chain

SECTION 3. GOVERNANCE OF LITHIUM MINING IN SALT FLATS

12. Which of the following GOVERNANCE CHALLENGES should be addressed as a priority? Select the four most important ones and rank them from 1 to 4 (1 is the most important).

	1	2	3	4
Secure property rights in the territories where lithium mining takes place.	○	○	○	○
Ensure citizen participation throughout the entire life cycle of the lithium mining projects.	○	○	○	○
Ensure the effective implementation of free, prior and informed consultation to indigenous people.	○	○	○	○
Strengthen the capacity of governments to monitor and control lithium mining.	○	○	○	○
Increase transparency and facilitate access to information related to lithium mining (e.g., environmental impact assessment reports, collection and use of tax-based resources).	○	○	○	○
Improve the state's tools and capacity to capture economic rent from lithium mining.	○	○	○	○
Implement policies that favour the development of national productive and technological capacities linked to lithium mining.	○	○	○	○
Develop standards that guarantee the traceability and sustainability of lithium mining products.	○	○	○	○

A just and sustainable lithium battery value chain

SECTION 4. INITIATIVES AND INSTRUMENTS FOR JUSTICE AND SUSTAINABILITY

The discussion regarding the justice and sustainability challenges faced by lithium

mining in the frame of the battery value chain makes it necessary to reflect on two questions: i) which are the most appropriate initiatives and instruments to face these challenges?; ii) which actors could lead these processes most effectively: the private sector, governments, international organisations and/or local communities, including indigenous peoples?

Below, we will ask you about these topics in an exploratory way. Your answers will be used as input for the next rounds of this study.

13. Which initiatives or policy tools would be most effective in promoting a lithium battery value chain that is JUST for the countries where lithium mining takes place? (max. 500 characters).

A just and sustainable lithium battery value chain
SECTION 4. INITIATIVES AND INSTRUMENTS FOR JUSTICE AND SUSTAINABILITY

14. Which actor(s) should be in charge of promoting these initiatives or policy tools? (max. 500 characters).

A just and sustainable lithium battery value chain
SECTION 4. INITIATIVES AND INSTRUMENTS FOR JUSTICE AND SUSTAINABILITY

15. Which initiatives or policy tools would be most effective in addressing the main SUSTAINABILITY challenges faced by lithium mining? (max. 500 characters).

A just and sustainable lithium battery value chain
SECTION 4. INITIATIVES AND INSTRUMENTS FOR JUSTICE AND SUSTAINABILITY

16. Which actor(s) should be in charge of promoting these policy initiatives or instruments? (max. 500 characters).

A just and sustainable lithium battery value chain
SECTION 5. GENERAL INFORMATION

Finally, we ask you to complete 6 questions with general information about your relationship with the lithium battery chain. Your answers will be processed for statistical purposes, respecting anonymity and confidentiality.

17. Gender

- ☐ Female
- ☐ Male
- ☐ I prefer not to say
- ☐ Other (please specify)

18. Age.

19. Country of residence.

20. Which group do you belong to or represent?

- ☐ Industry
- ☐ Government
- ☐ International Organization
- ☐ Academia
- ☐ Indigenous Community
- ☐ Non-governmental organizations
- ☐ Other (please specify)

21. Which of the following activities best describes your participation and/or interest in the lithium battery value chain?

- ☐ Production
- ☐ Policy making and legislation
- ☐ Research and development
- ☐ Human rights defense
- ☐ Other (please specify)

22. Which stage of the lithium battery value chain do you relate to and/or have experience with?

- ☐ The exploration, extraction and production of lithium
- ☐ The recycling of lithium batteries
- ☐ The production of lithium batteries and its components
- ☐ The production of goods which utilize lithium batteries
- ☐ Other (please specify)

Green Dealings

Round 2. A just and sustainable lithium battery value chain

Welcome back!

We thank you for your participation in this Delphi study, which is conducted within the framework of the project "Green Dealings: Negotiating Lithium between South America and Europe for Batteries that fuel a just transition". A total of 141 experts participated in the first round of the survey. Two thirds of the participants came from the lithium triangle countries (Argentina, Bolivia and Chile), European participants represented 22% of the panel, while the rest of participants came from other countries. The distribution of the panel in terms of sector affiliation was as follows: 37% belonged to the academic sector; 25% to industry; 18% to governments; 15% to non-governmental organizations; 4% to international organizations and 1% to indigenous communities.

Based on the results of the first round, we ask you to answer again some questions about sustainability and justice within the lithium battery value chain. The objective of this exercise is to evaluate what are the emerging points of consensus and continued disagreement on the topics covered in the study. In some cases, we have incorporated new options into the menu of choices, which have emerged from the answers to the open questions asked in Round 1. Also, we include some new questions about policy tools and strategies to address the identified challenges, based on the answers to the open questions of the previous round.

The estimated time to complete the survey is **30 minutes.** Your answers will be processed for statistical purposes, respecting anonymity and confidentiality. Please enter your e-mail address below. This will allow to have a record of the answers. The survey must be completed by **December 12**, 2022.

Once the study is completed, you will be invited to a virtual meeting to discuss the results, anonymized and aggregated from all responses. In this way, the participants in the Delphi survey have the opportunity to validate the results, as well as to benefit from seeing how perspectives on the challenges facing the battery value chain differ across the sector.

We thank you again for your valuable time.

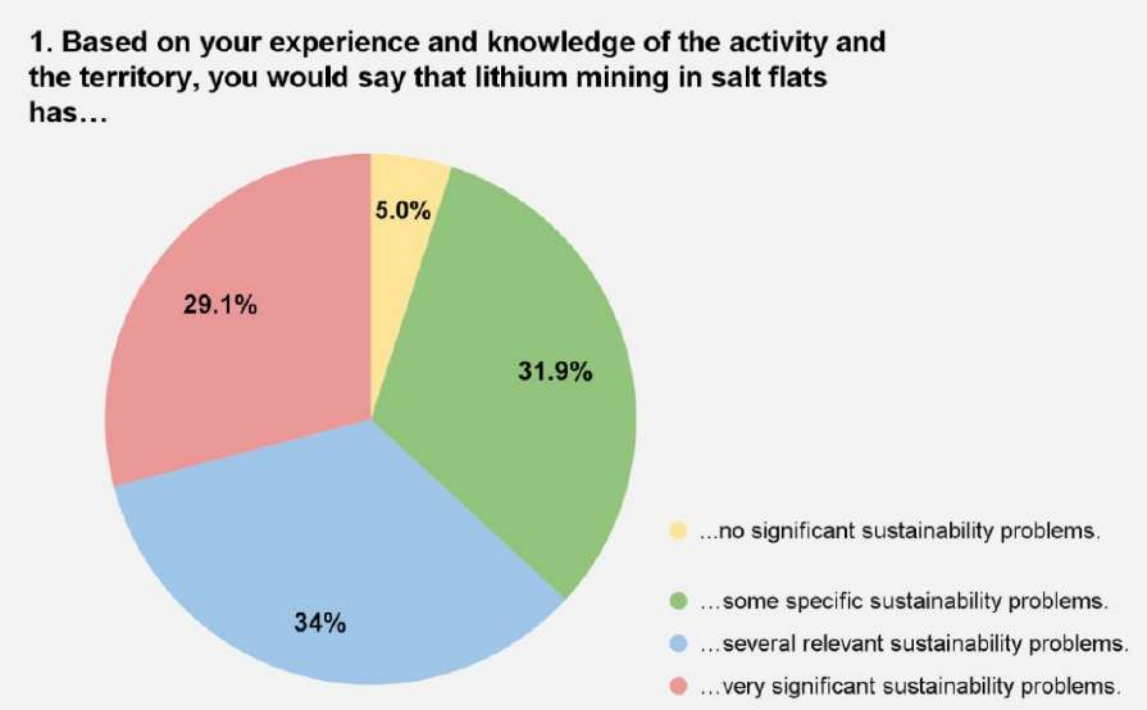
E-mail

Green Dealings

Round 2. A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

In Round 1, we asked the panel to make an overall assessment of the **SUSTAINABILITY** problems experienced by the lithium mining industry and, if they existed, evaluate their magnitude. The figure below reports the responses. Two-thirds of the panel considered that lithium mining experiences several relevant or very significant sustainability problems.



1. Taking into account the information reported so far on results of Round 1, you would say that lithium mining in salt flats...

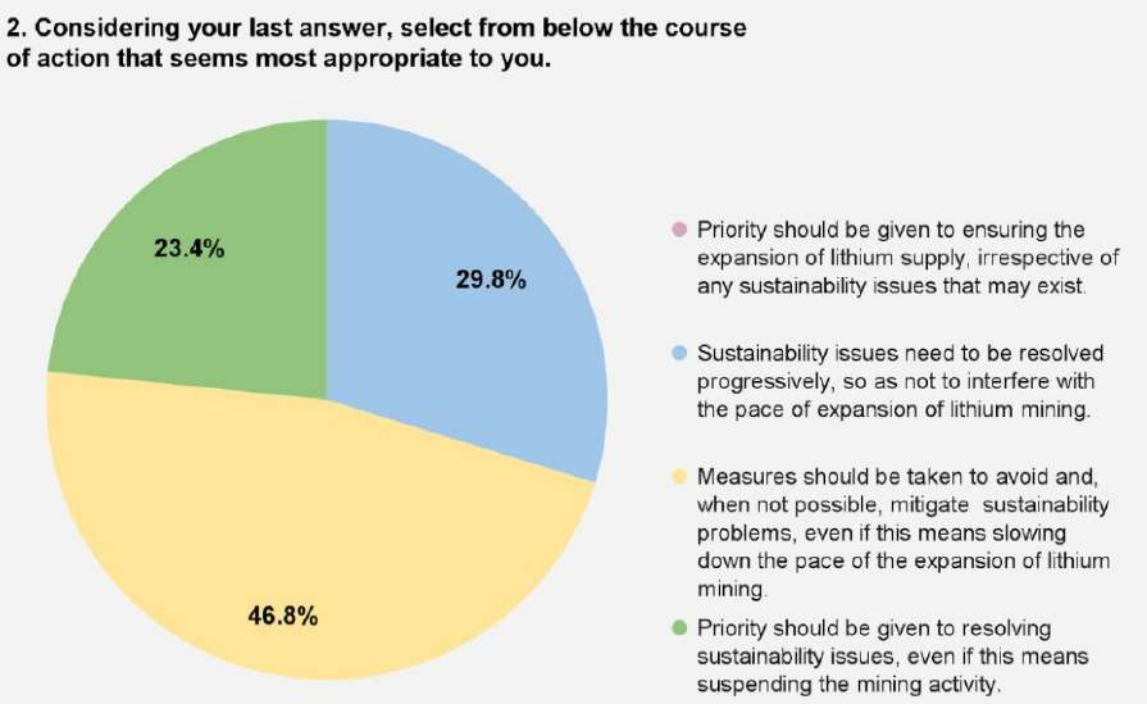
- ◯ ...has no significant sustainability problems.
- ◯ ...has some specific sustainability problems.
- ◯ ...has several relevant sustainability problems.
- ◯ ...has very significant sustainability problems.

Green Dealings

Round 2. A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

Based on the previous answer, the panel was then asked their opinion on what would be the most appropriate course of action to address sustainability problems. The figure below reports the responses. Nearly 47% of the panel believed that measures should be taken to avoid or mitigate sustainability issues, even if it slows the pace of lithium mining expansion. Around 23% of the panel proposed to address these problems as a priority, even if it implies the suspension of mining activity; while almost 30% considered that problems can be solved without affecting the pace of expansion of the activity. No one chose to prioritize ensuring the expansion of lithium supply irrespective of any sustainability issues that may exist.



2. Taking this information into account, what do you think is the most appropriate course of action from the point of view of lithium mining sustainability in salt flats?

- ◯ Priority should be given to ensuring the expansion of lithium supply, irrespective of any sustainability issues that may exist.
- ◯ Sustainability issues need to be resolved progressively, so as not to interfere with the pace of expansion of lithium mining.
- ◯ Measures should be taken to avoid and, when not possible, mitigate sustainability problems, even if this means slowing down the pace of the expansion of lithium mining.
- ◯ Priority should be given to resolving sustainability issues, even if this means suspending the mining activity.

Green Dealings

Round 2. A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

3. In Round 1 the panel was asked about the main sustainability challenges of lithium mining in salt flats. The following statements have been formulated based on some of the responses. On a scale of 1 to 7, where 1 means "strongly disagree" and 7 means "strongly agree", please indicate your degree of agreement or disagreement with these statements.

Statement 1

It is necessary to develop new production processes in lithium mining in salt flats that have a low impact on water availability and on the biodiversity of the territories where it is carried out.

Strongly disagree — Strongly agree

Statement 2
National and subnational governments in the lithium triangle countries have adequate institutional capabilities to monitor the environmental and social impacts of lithium mining.

Strongly disagree Strongly agree

Statement 3
Currently, there is a lack of sufficient information and reliable models to evaluate the impact of freshwater and brine pumping associated with lithium mining on the hydrological balance of the salt flats and on the basin where they are located.

Strongly disagree Strongly agree

Statement 4
Currently there are no mechanisms that sufficiently guarantee social participation in decision-making on lithium mining. These mechanisms should ensure the right to say “no” and the participation of communities in the economic benefits of the activity.

Strongly disagree Strongly agree

Statement 5
The countries of the lithium triangle in South America have been able to use their lithium resource endowment as a lever to promote the development of production and technological capabilities.

Strongly disagree Strongly agree

Statement 6
Countries that demand lithium as an input, mainly for battery production, promote the application of strict environmental and community consultation standards by companies that produce lithium compounds from brines.

Strongly disagree Strongly agree

Green Dealings

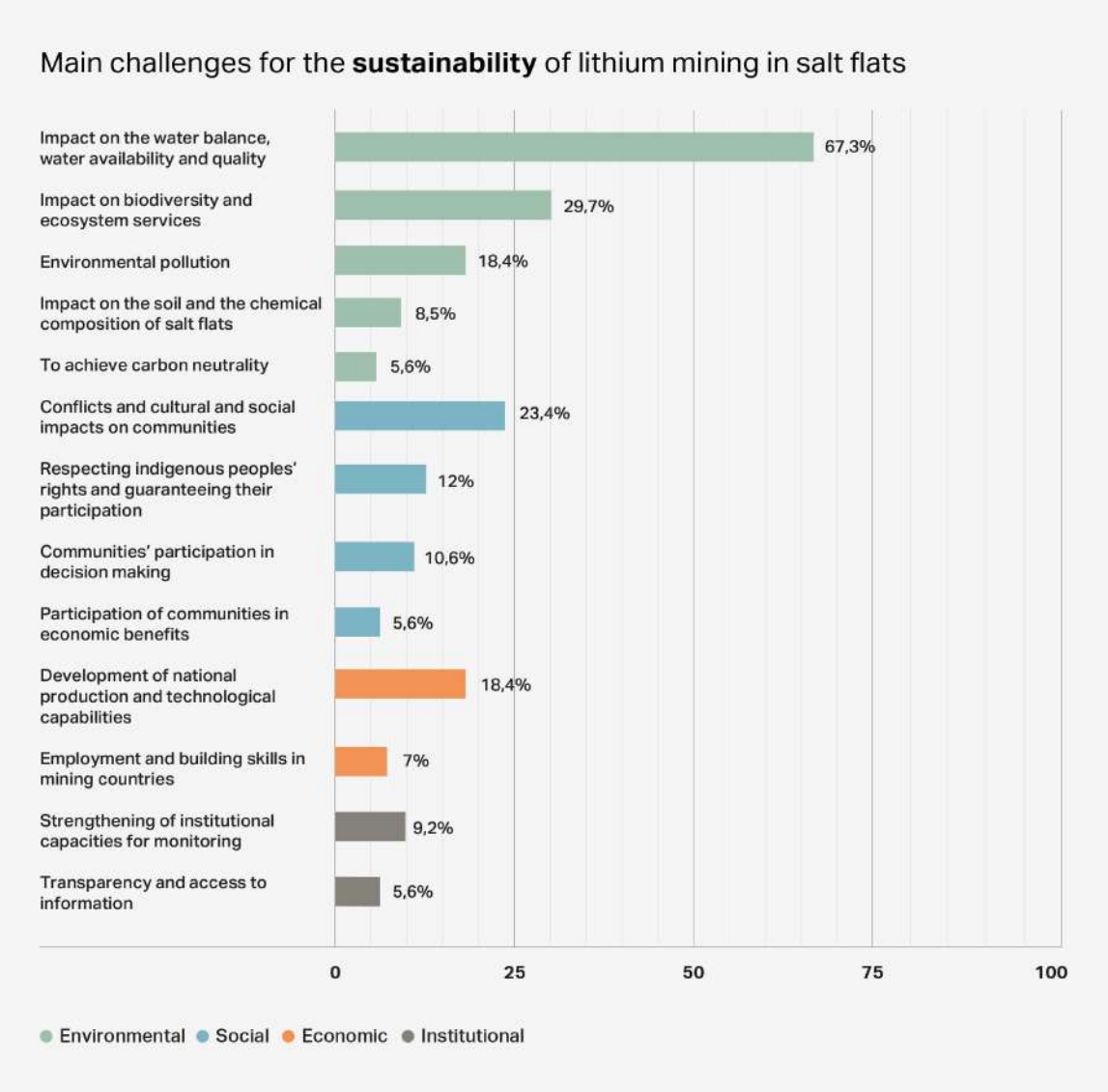
Round 2. A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

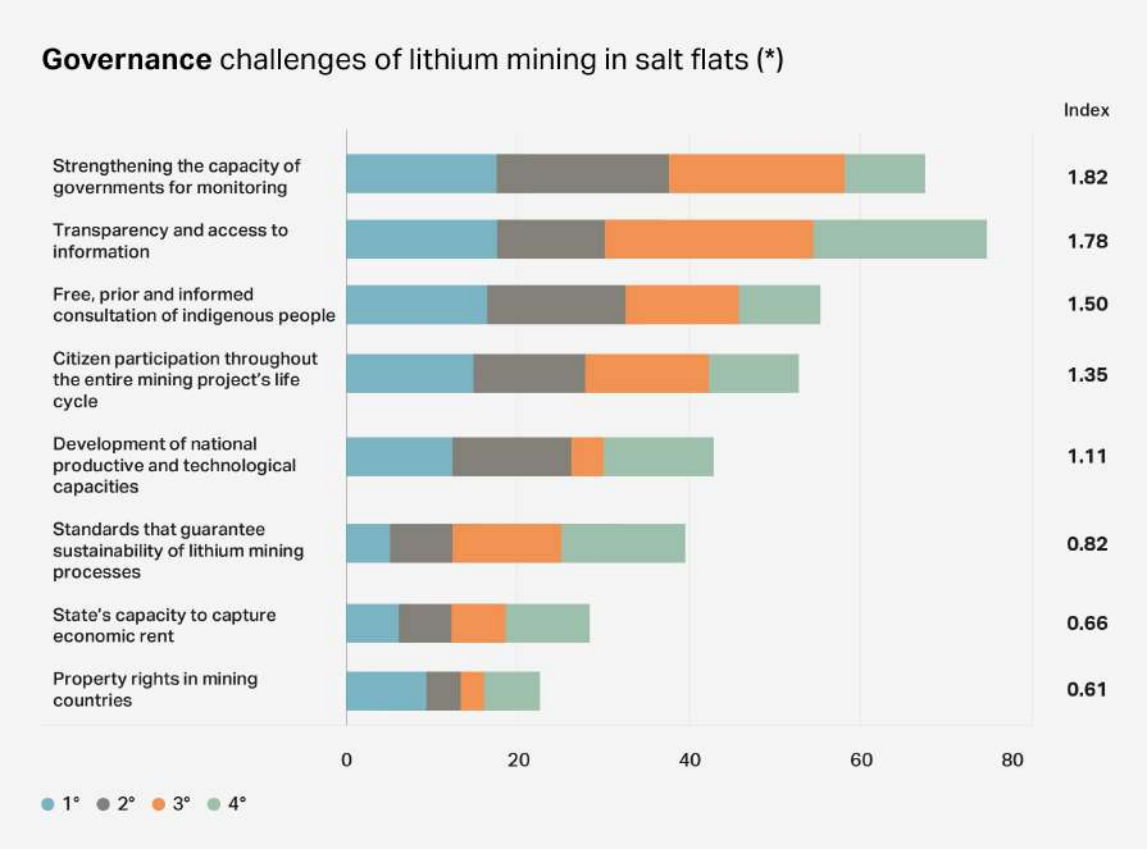
In this section, the results of round 1 are reported, which will then be explored in depth in the following questions. In particular, we report the results of the open-ended question on the main **challenges for the sustainability** of lithium mining, and the closed-ended question on the main **challenges for the governance** of the activity.

The following figure reports the panel's responses in the first round of the study to the open-ended question on what are the main **SUSTAINABILITY CHALLENGES** of lithium mining in salt flats.

Overall, environmental sustainability challenges appear in the first place. In particular, the impacts of the activity on the hydrological balance and the water availability in the basin of the salt flats are highlighted. Also, respondents stressed the adverse impacts on biodiversity and the ecosystems where the salt flats are located. The social challenges are identified in the second place, whereas the economic challenges appear in the third place. The panel also pointed out challenges related to access to information and institutional capabilities to control mining activities. The sum of the percentages exceeds 100% because the question allowed for more than one answer.



In Round 1, we asked the panel to indicate the four **GOVERNANCE CHALLENGES** that should be addressed as a priority, ranking them from 1 to 4 (being 1 the most important). The figure below shows the frequency of each response considering the order of preference given by the panel. Firstly, it is the need to strengthen state capabilities for monitoring and controlling lithium mining. Secondly, to increase transparency and facilitate access to information on the activity. And thirdly, the need to guarantee free, prior and informed consultation with indigenous peoples and the participation of local communities. In this second round, governance issues will be incorporated in the questions referring to specific initiatives to promote a sustainable and just value chain.



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Green Dealings

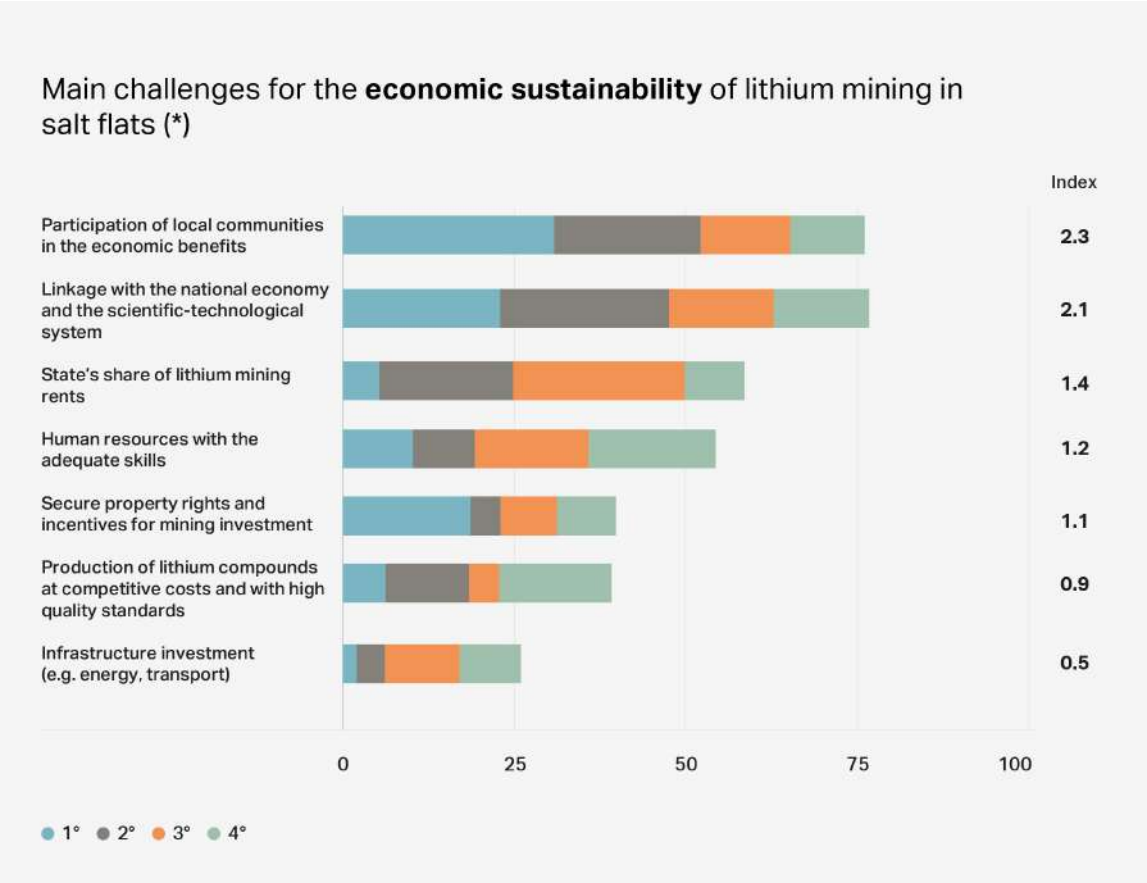
Round 2. A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

In the first round of the study, the panel was asked to indicate which sustainability challenges are priorities. Following a classic vision of sustainable development, these challenges were grouped along three dimensions, referring to economic growth, social inclusion and environmental protection.

The following figure presents the results of the question on **ECONOMIC SUSTAINABILITY** challenges. The panel considers that improving the

participation of communities in the economic benefits of lithium mining and the linkages with the national economy and the science and technology system should be addressed as a priority. These priorities are followed by a greater State's share in the economic rent from lithium mining and the training of human resources to meet the demands of the mining activity.



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4. Based on this information, which of the following ECONOMIC SUSTAINABILITY CHALLENGES should be addressed as a priority? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important)..

	1	2	3	4
Improve the participation of local communities in the economic benefits of lithium mining.	◯	◯	◯	◯
Link lithium mining with the national economy and the scientific-technological system to build domestic capacities.	◯	◯	◯	◯
Improve the State's share of the economic rent from lithium mining.	◯	◯	◯	◯
Have human resources with the necessary skills to work in lithium mining.	◯	◯	◯	◯
Provide legal security and incentives for mining investment.	◯	◯	◯	◯
Produce lithium compounds at competitive costs and high quality standards.	◯	◯	◯	◯
Increase transparency and facilitate access to economic and fiscal information on mining activity.	◯	◯	◯	◯
Develop infrastructure for mining in salt flats (e.g., energy, transport).	◯	◯	◯	◯

5. Which of the following PUBLIC POLICY INITIATIVES or TOOLS should be implemented as a priority to address these ECONOMIC SUSTAINABILITY CHALLENGES? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

	1	2	3	4
Participatory and multi-stakeholder consultation processes to agree on how to improve the participation of local communities in the economic benefits of lithium mining.	◯	◯	◯	◯
Changes in the regulatory and institutional framework to ensure greater participation of local communities in the economic benefits of lithium mining.	◯	◯	◯	◯
Public policies to promote the development of production and technological capabilities in mining countries (e.g., technology transfer agreements or setting conditions that facilitate the development of local suppliers).	◯	◯	◯	◯
Changes in legislation to increase the State´s share (including state-owned companies) in the economic rent of lithium mining.	◯	◯	◯	◯
Educational and professional training policies to promote the acquisition of technical skills necessary for lithium mining.	◯	◯	◯	◯
Establish tax incentives to promote mining investment.	◯	◯	◯	◯
Increase technical capabilities and coordination between national and subnational public agencies with the mandate to monitor and produce information on lithium mining.	◯	◯	◯	◯

Others (specify):

6. Considering the initiative you selected as MOST IMPORTANT, select the three actors that should play a key role in promoting it, ranking them from 1 to 3 (1 being the most important).

	1	2	3
Local communities.	◯	◯	◯
Civil society and non-governmental organizations.	◯	◯	◯
Universities and other research institutions.	◯	◯	◯
Mining sector workers and labor unions.	◯	◯	◯
Lithium mining companies.	◯	◯	◯
Companies that require lithium products.	◯	◯	◯
Sub-national governments.	◯	◯	◯
Governments of lithium producing countries.	◯	◯	◯
Governments of lithium-importing countries.	◯	◯	◯
International organizations and agencies.	◯	◯	◯

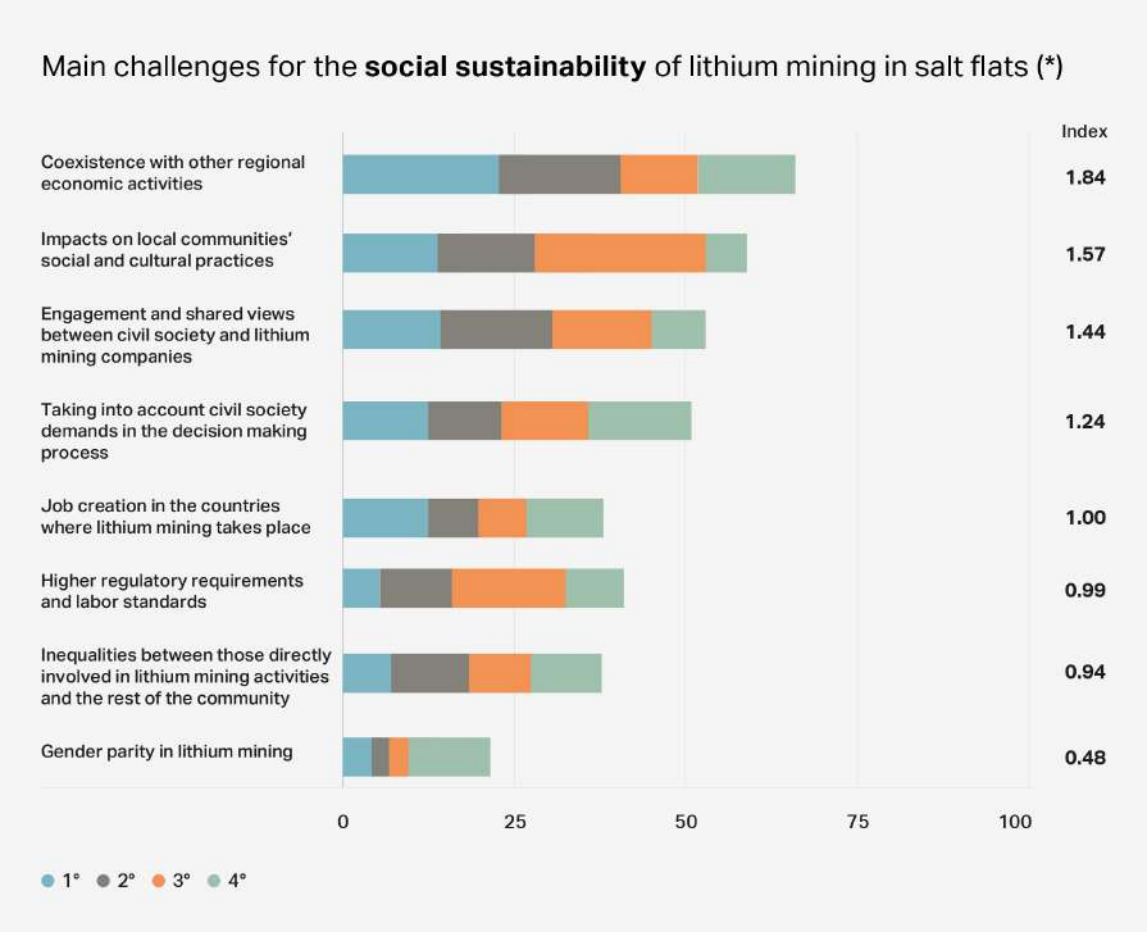
Others (specify):

Green Dealings

Round 2. A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

The following figure presents the results of the question on **SOCIAL SUSTAINABILITY** challenges. The panel considers that the coexistence of lithium mining with other regional economic activities should be addressed as a priority. This is followed by mitigating negative impacts on the social and cultural practices of communities. Then, the panel highlighted the need to improve engagement practices and build shared views between society and companies, and to incorporate the demands of civil society in the process of defining the terms under which the activity is carried out.



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7. Considering this information, which of the following SOCIAL SUSTAINABILITY CHALLENGES should be addressed as a priority? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

	1	2	3	4
Develop a strategy that allows for the coexistence of lithium mining with other regional economic activities (e.g. tourism or agriculture).	◯	◯	◯	◯
Mitigate the negative impacts of the mining activity on social and cultural practices of local communities.	◯	◯	◯	◯
Implement good practices of engagement and build shared views between civil society and lithium mining companies.	◯	◯	◯	◯
Take into account civil society demands in the process of defining the terms under which lithium mining is carried out.	◯	◯	◯	◯
Promote job creation in the countries where lithium mining takes place.	◯	◯	◯	◯
Raise regulatory requirements and labour standards for mining companies and their suppliers.	◯	◯	◯	◯
Mitigate the inequalities generated between those directly involved in mining activities and the rest of the community.	◯	◯	◯	◯
Promote gender parity in lithium mining activities in salt flats.	◯	◯	◯	◯
Improve communication and information on mining activities between companies, governments and local communities.	◯	◯	◯	◯

8. Which of the following PUBLIC POLICY INITIATIVES or TOOLS should be implemented as a priority to address these SOCIAL SUSTAINABILITY CHALLENGES? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important)

	1	2	3	4
Conduct strategic and land-use planning that favors the coexistence of lithium mining with other regional economic activities (e.g. tourism or agriculture).	◯	◯	◯	◯
Develop consultation mechanisms that incorporate the perspectives of different stakeholders and are sensitive to cultural diversity (e.g., for prior consultation with indigenous peoples).	◯	◯	◯	◯
Multi-stakeholder consultation processes to agree on how to mitigate the negative impacts of lithium mining on the social and cultural practices of local communities.	◯	◯	◯	◯
Changes in legislation to mitigate and compensate for the negative impacts of lithium mining on the social and cultural practices of local communities.	◯	◯	◯	◯
Increase incentives for companies to improve community engagement practices and mitigate the negative impacts of lithium mining on the social and cultural practices of local communities.	◯	◯	◯	◯
Changes in legislation to ensure that companies incorporate the demands of civil society in the process of defining the terms under which lithium mining is carried out	◯	◯	◯	◯
Create incentives for local job creation and training of local community members, especially favoring the inclusion of vulnerable groups.	◯	◯	◯	◯

Other (specify)

9. Considering the initiative you selected as MOST IMPORTANT, select the three actors that should play a key role in promoting it, ranking them from 1 to 3 (being 1 the most important).

	1	2	3
Local communities.	◯	◯	◯
Civil society and non-governmental organizations.	◯	◯	◯
Universities and other research institutions.	◯	◯	◯
Mining sector workers and labor unions.	◯	◯	◯
Lithium mining companies.	◯	◯	◯
Companies that require lithium products.	◯	◯	◯
Sub-national governments.	◯	◯	◯
Governments of lithium producing countries.	◯	◯	◯
Governments of lithium-importing countries.	◯	◯	◯
International organizations and agencies.	◯	◯	◯

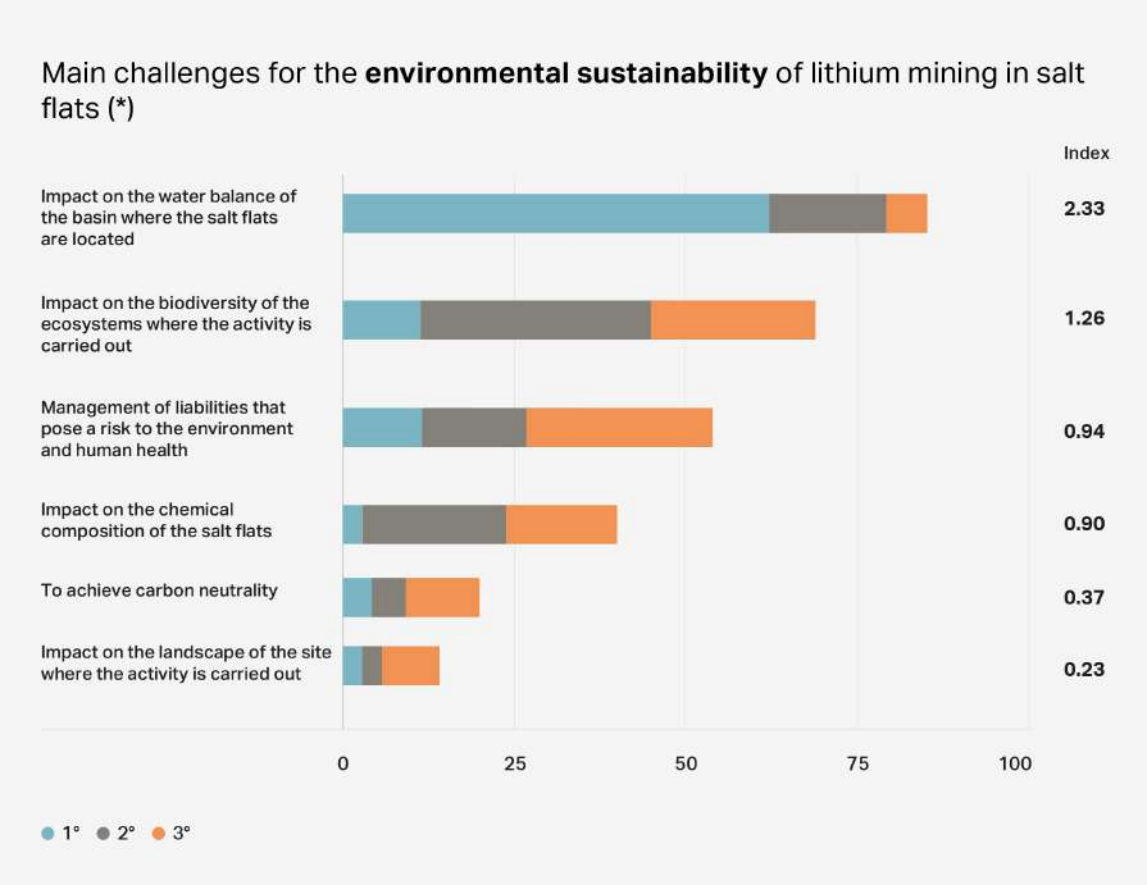
Others (specify)

Green Dealings

Round 2. A just and sustainable lithium battery value chain

SECTION 1. SUSTAINABILITY OF LITHIUM MINING IN SALT FLATS

The figure below presents the results of the question on **ENVIRONMENTAL SUSTAINABILITY** challenges. The panel considers that the impact on the water balance of the basin where the salt flats are located should be addressed as a priority. This is followed by avoiding or mitigating the negative impact of lithium mining on the biodiversity of the ecosystems where the activity is carried out and improving the management of liabilities that pose a risk to the environment and human health. Also, the panel highlighted the need to avoid or mitigate the impact on the chemical composition of the salt flats from which the brine is extracted.



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10. Based on this information, which of the following ENVIRONMENTAL SUSTAINABILITY CHALLENGES should be addressed as a priority? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

	1	2	3
Avoid or mitigate the negative impact of lithium mining on the water balance of the basin where the salt flats are located.	◯	◯	◯
Avoid or mitigate the negative impact of lithium mining on the biodiversity of the ecosystems where the activity is carried out.	◯	◯	◯
Improve the management of lithium mining liabilities that pose a risk to the environment and human health (e.g., waste).	◯	◯	◯
Avoid or mitigate the negative impact of lithium mining on the chemical composition of the salt flats from which the brine is extracted.	◯	◯	◯
Achieve carbon neutrality of lithium mining.	◯	◯	◯
Avoid or mitigate the negative impact of lithium mining on the landscape of the site where the activity is carried out.	◯	◯	◯
Decrease the demand for lithium, for example through initiatives that promote battery recycling.	◯	◯	◯

11. Which of the following PUBLIC POLICY INITIATIVES or TOOLS should be implemented as a priority to address these CHALLENGES to ENVIRONMENTAL SUSTAINABILITY? Select the three most important ones, ranking them from 1 to 3 (being 1 the most important).

	1	2	3
Increase state investment to create baselines, improve the generation and transparency of public environmental information, especially on water balance and biodiversity issues in each salt flat.	◯	◯	◯
Promote multi-stakeholder cooperation (alliances between companies, government and research institutions, etc.) in mining countries to address the challenges of water balance and biodiversity in each salt flat.	◯	◯	◯
Increase state investment to strengthen government monitoring capacity and ensure compliance with environmental standards.	◯	◯	◯
Changes in legislation that ensure greater community participation in environmental monitoring and decision-making processes on environmental issues.	◯	◯	◯
Increase investment in the development of new extraction technologies that substantially reduce impacts on the water balance and biodiversity.	◯	◯	◯
Regulatory changes in mining countries requiring compliance with rigorous environmental standards, external audits and certifications.	◯	◯	◯
Regulatory changes in lithium-importing countries requiring compliance with rigorous environmental standards, external audits and certifications.	◯	◯	◯

Others (specify)

12. Considering the initiative you selected as MOST IMPORTANT, select the three actors that should play a key role in promoting it, ranking them from 1 to 3 (being 1 the most important).

	1	2	3
Local communities.	◯	◯	◯
Civil society and non-governmental organizations.	◯	◯	◯
Universities and other research institutions.	◯	◯	◯
Mining sector workers and labor unions.	◯	◯	◯
Lithium mining companies.	◯	◯	◯
Companies that require lithium products.	◯	◯	◯
Sub-national governments.	◯	◯	◯
Governments of lithium producing countries.	◯	◯	◯
Governments of lithium-importing countries.	◯	◯	◯
International organizations and agencies.	◯	◯	◯

Others (specify)

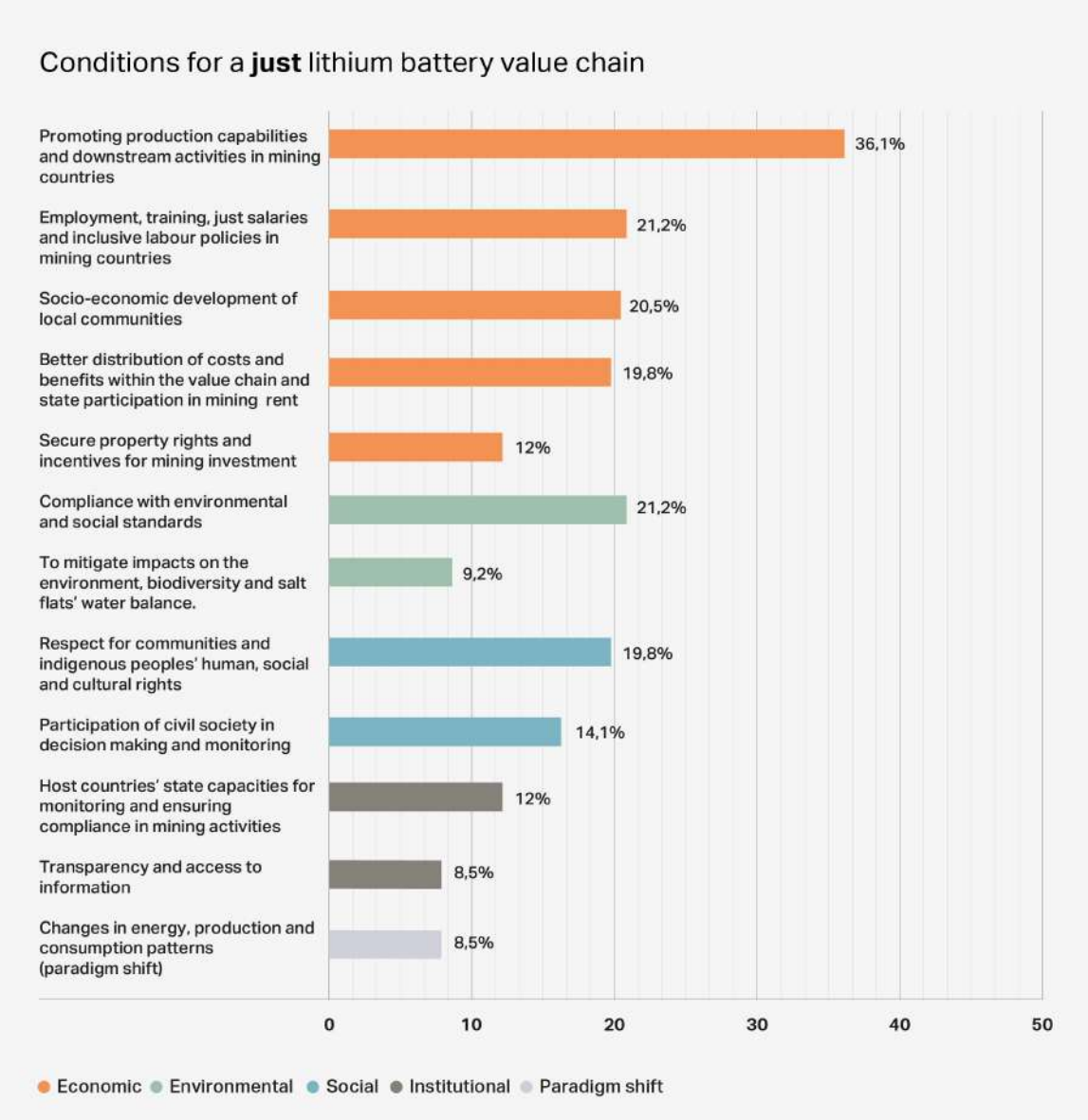
Green Dealings

Round 2. A just and sustainable lithium battery value chain

SECTION 2. A JUST LITHIUM BATTERY VALUE CHAIN

The figure below reports the panel's responses in Round 1 of the study to the open-ended question on what **CONDITIONS** the lithium-ion battery value chain should meet to be considered **JUST** for the countries where lithium mining is developed.

Overall, most of the answers refer to economic or social aspects of the value chain.The panel ranked first the development of production and technological capabilities in lithium-producing countries. Then, the panel prioritized the generation of quality employment, the promotion of local development and the respect for the rights of local communities and the compliance with social and environmental standards. The sum of the percentages exceeds 100% because the question allowed for more than one answer.



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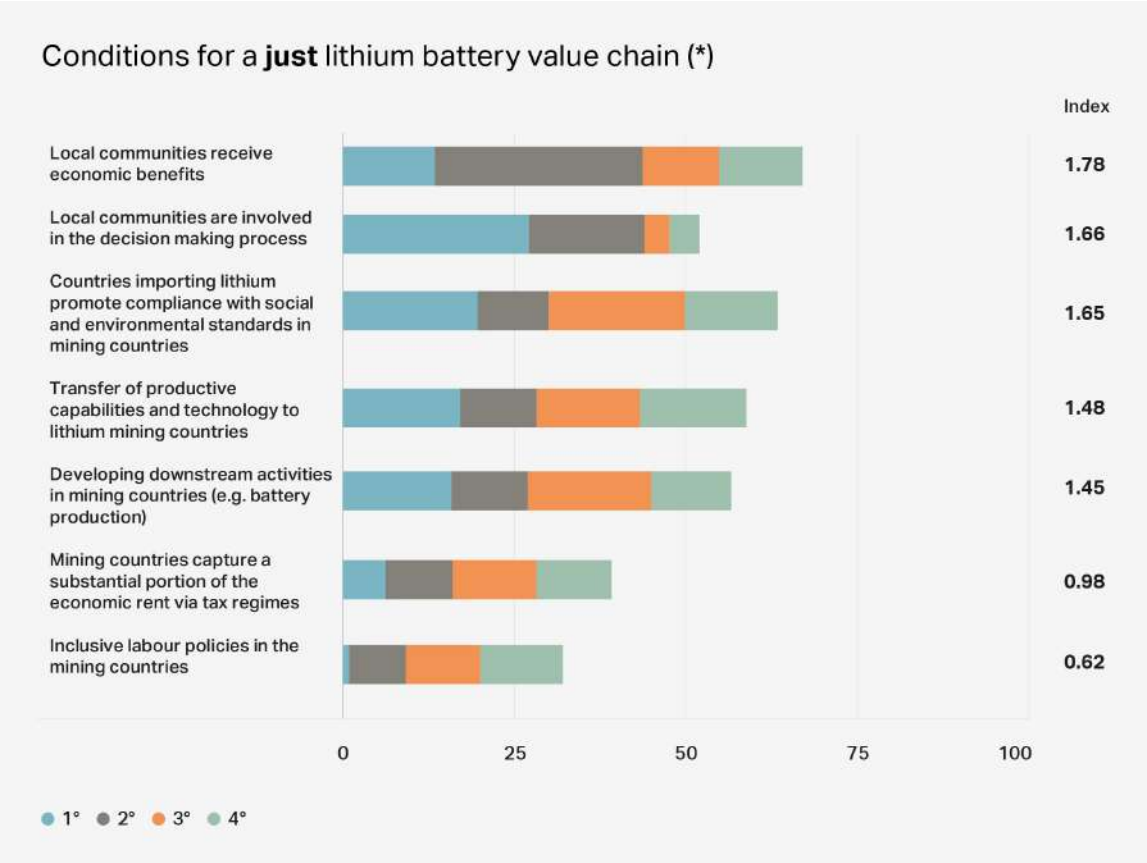
Round 2. A just and sustainable lithium battery value chain

SECTION 2. A JUST LITHIUM BATTERY VALUE CHAIN

The panel was then asked to indicate which **CONDITIONS** should be promoted as a PRIORITY to make the lithium battery value chain **JUST**. The figure below reports the responses. In first place appears the participation of local communities in the economic benefits and the definition of the terms under which lithium mining is carried out in salt flats. In second place, companies' compliance with social and environmental standards.

And, in third place, the increase of productive and technological capacities in lithium-rich countries.



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13. Taking into account the information reported on results of Round 1, what CONDITIONS should be promoted so that the lithium battery value chain becomes JUST? Select the four most important ones, ranking them from 1 to 4 (being 1 the most important).

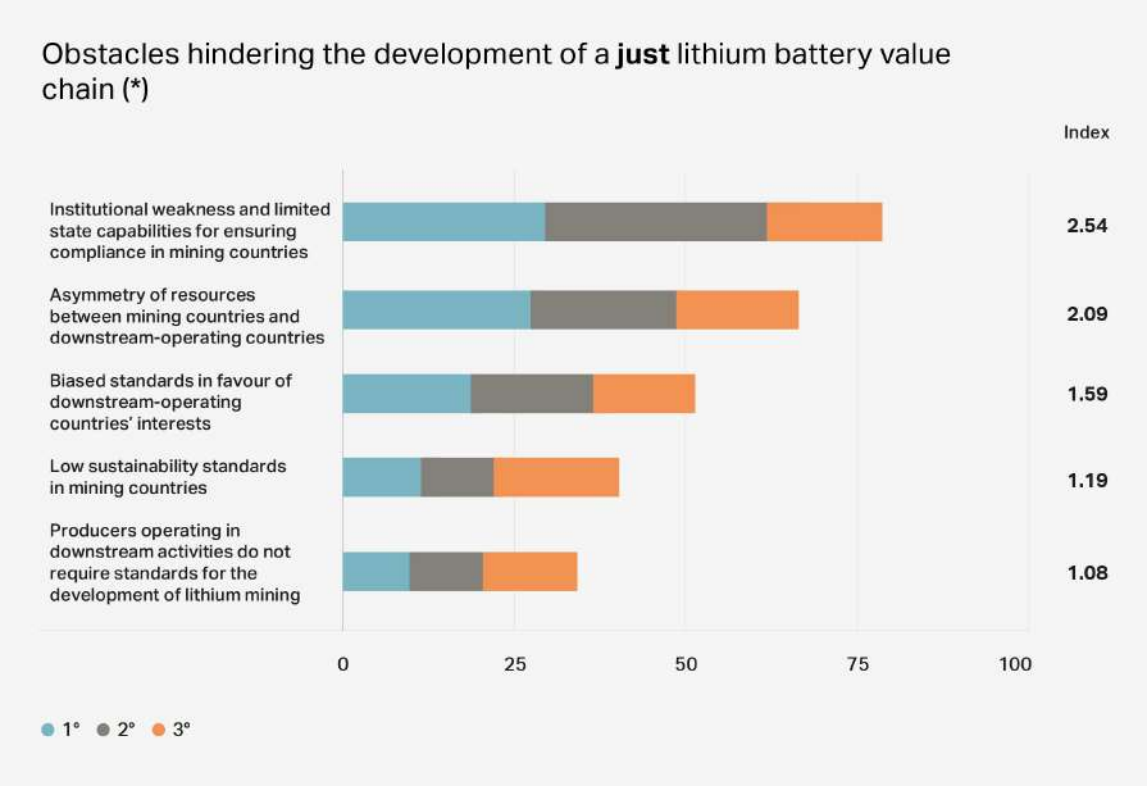
	1	2	3	4
Local communities receive economic benefits from lithium mining.	◯	◯	◯	◯
Local communities are involved in defining the terms under which lithium mining is carried out.	◯	◯	◯	◯
Countries importing lithium promote compliance with social and environmental standards in countries where lithium mining takes place.	◯	◯	◯	◯
Countries importing lithium favor the transfer of production and technological capabilities to the countries where the resource is located.	◯	◯	◯	◯
Mining countries succeed in developing downstream activities in the value chain (e.g., battery production).	◯	◯	◯	◯
Tax regimes in mining countries have the capacity to capture a substantial portion of the economic rent from lithium mining.	◯	◯	◯	◯
Inclusive labor policies prevail and workers' rights are respected in the development of lithium mining.	◯	◯	◯	◯
The rights and culture of local communities are respected.	◯	◯	◯	◯
Significant changes in consumption, production and mobility patterns are promoted, especially in the developed economies, in order to reduce the demand for lithium and the pressures on territories.	◯	◯	◯	◯

Green Dealings

Round 2. A just and sustainable lithium battery value chain

SECTION 2. A JUST LITHIUM BATTERY VALUE CHAIN

In Round 1, we asked the panel to indicate the three most relevant **OBSTACLES** in building a lithium battery value chain that is **JUST** for the countries where lithium mining takes place, ranking them from 1 to 3 (being 1 the most important). Firstly, the panel underlined the institutional weaknesses and state capabilities in lithium-rich countries , and secondly, the asymmetry of resources between these countries and those that require lithium as an input for other productive processes.



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14. Taking this information into account, which of these OBSTACLES do you think are the most relevant for the construction of a lithium battery value chain that is JUST for the countries where mining takes place? Indicate the three most relevant, ranking them from 1 to 3 (1 being the most relevant).

	1	2	3
The institutional weakness and limited capabilities of the state in lithium-rich countries do not guarantee compliance with sustainability standards in lithium mining.	◯	◯	◯
The asymmetry of resources between mining countries and downstream-operating countries (e.g. access to financial resources).	◯	◯	◯
The high demand for lithium encourages mining countries to export it with low added value.	◯	◯	◯
Battery producing countries have a greater capacity to influence the definition of standards, which could lead to these standards being biased in favor of their interests.	◯	◯	◯
Countries with lithium brine resources adopt low sustainability standards .	◯	◯	◯
Producers operating in downstream activities (e.g. battery producers) do not require sustainability standards in the development of lithium mining.	◯	◯	◯
There are insufficient regulatory or economic incentives for companies to develop their activities under stricter social and environmental sustainability standards.	◯	◯	◯

Others (specify)

Green Dealings

Round 2. A just and sustainable lithium battery value chain

Thank you very much for your time!

At the end of the study, you will be invited to a virtual meeting to discuss the results.

About the authors

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