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# Navigating Sustainability in Lithium Extraction: Local Perceptions of Environmental and Economic Impacts in the Cínovec Region, Czech Republic

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**Abstract:** Driven by the accelerating global demand for lithium as a strategic raw material for renewable energy storage systems and electric mobility, extensive extraction projects have been proposed across Europe. Among the most prominent is the development of lithium reserves in the Cínovec region of the Czech Republic. This study investigates how local actors perceive the anticipated environmental, economic, and social impacts of lithium mining in the region, and whether current regulatory and governance frameworks are perceived as sufficient to ensure sustainable mining practices. A mixed-methods approach has been employed, combining qualitative data from semi-structured interviews with policymakers, municipal leaders, mining license holders, and regional stakeholders, with quantitative analysis of public opinion data obtained through a survey of 256 residents, along with the systematic review of Environmental Impact Assessments (EIA), policy documents, and socio-economic datasets. The findings reveal a prevailing skepticism among local stakeholders regarding the project, with strong opposition rooted in concerns over environmental degradation—including risks to water quality, biodiversity, and landscape integrity. While economic benefits such as job creation and regional investment are acknowledged, doubts have been expressed about the equitable distribution of these benefits and the transparency of decision-making processes. A lack of effective public engagement and communication has been identified as a key factor exacerbating community distrust. Moreover, regulatory instruments have been perceived as fragmented and insufficiently enforced, raising questions about institutional readiness for sustainable resource governance. It is concluded that without substantial reforms to enhance procedural transparency, participatory governance, and environmental oversight, social acceptance of the project is unlikely to be secured. These results underscore the importance of aligning resource extraction initiatives with local socio-environmental contexts and of embedding sustainability principles within all phases of project development. The study contributes to current debates on critical raw material governance in the European Union and offers policy-relevant recommendations for designing inclusive, transparent, and environmentally responsible mining strategies that are sensitive to community resilience and long-term regional sustainability.

**Keywords:** Lithium extraction; Sustainability; Stakeholder perceptions; Environmental governance; Regional development; Mining policy; Cínovec

## 1. Introduction

The interest in lithium (Dorn & Peyré, 2020; Gourcerol et al., 2019; Kavanagh et al., 2018) has initiated a search for new lithium resources, and plans have therefore been created to open new mining operations once new deposits have been mapped. Innovations in lithium-ion battery manufacturing processes (Shin et al., 2022; Manthiram et al., 2017) represent huge potential for reducing the overall cost of these batteries, which may lead to the wider adoption and diffusion of electric vehicles and other battery-dependent technologies (Cai et al., 2018). In addition to the economic aspects, it is also necessary to address the environmental impacts of lithium mining and processing,

which highlights the importance of sustainable production (Aznar-Sánchez et al., 2019) and recycling methods (Ziemann et al., 2012).

However, the environmental sustainability of lithium mining is a multidisciplinary issue that needs to be addressed from several angles. Rockström et al. (2009) highlight the risk of crossing environmental boundaries such as climate change, loss of biodiversity and changes in the global nitrogen cycle, which increase the urgency to find a sustainable approach to lithium mining.

One key issue is the environmental impact. Indeed, the technology and process of lithium mining and processing are associated with negative impacts on environmental quality, particularly in terms of landscape degradation, loss of water resources and pollution. Liu & Agusdinata (2020) have highlighted the significant decline in water supplies as a result of mining activities, which negatively affects water availability (Dudka & Adriano, 1997). Surface and groundwater pollution is also a risk, as it reduces biodiversity and has human health impacts due to water pollution (Wanger, 2011). Rare metal mining can lead to high levels of heavy metal pollution in soil and water (Li et al., 2014), and metal mining and refining processes can have significant environmental impacts, including toxic contamination (Langkau & Erdmann, 2021). Other heavy metals and toxic compounds are found in the production process in addition to lithium (Gwenzi et al., 2018). As stated by Flexer et al. (2018), hard rock mining can lead to deforestation, soil erosion and pollution of water resources due to tailings and mining waste. It also requires significant amounts of water and energy. From a socio-economic perspective, lithium mining can have a significant positive impact on economic development and job creation in communities (Moritz et al., 2017), as shown in a study conducted in the Salar de Atacama region of Chile (Agusdinata et al., 2018).

Mining of lithium and precious metals may also pose specific risks to human health due to exposure to chemicals and pollution (Li et al., 2014). According to Entwistle et al. (2019), these can manifest as both acute and chronic health problems in affected communities. Dust and aerosols from mining can contain hazardous particles that, when inhaled, can lead to respiratory illnesses including asthma and chronic obstructive pulmonary disease. Bioaccumulation of toxic chemicals, including heavy metals and acids in the food chain can lead to long-term health problems, including neurological disorders and damage to the reproductive system (Li et al., 2014).

On one hand, it can generate new employment opportunities and stimulate local economies, particularly in structurally weak areas (Moritz et al., 2017). On the other hand, insufficiently regulated mining activities often lead to unequal distribution of benefits, increased pressure on local infrastructure, and social tensions, especially when local communities are excluded from decision-making processes (Liu & Agusdinata, 2020; Entwistle et al., 2019). These findings highlight the need to consider not only ecological impacts but also local expectations, distributive justice, and community engagement when evaluating the broader implications of mining.

The Ministry of the Environment in the Czech Republic, as the relevant authority, is collecting data from individual stakeholders in this project. The framework for mining in the Czech Republic is established by several legal regulations and decrees:

- Mining Act: Act No. 44/1988 Coll., on the Protection and Utilisation of Mineral Resources (Mining Act). This law sets out the basic rules for mining and the protection of mineral resources within the Czech Republic. It defines procedures for obtaining mining rights, the obligations of mining companies and measures for environmental protection (Czech Mining Legislation, 1988).
- Environmental Protection Act: Act No. 114/1992 Coll., on Nature and Landscape Protection. This law protects nature and the landscape and regulates the conditions under which mining can be permitted in protected areas (Czech Environmental Protection Legislation, 1992).
- Environmental Damage Prevention Act: Act No. 167/2008 Coll., on Prevention and Remedying Environmental Damage. This law deals with the prevention and remediation of environmental damage caused by mining activities (Czech Environmental Damage Prevention Legislation, 2008).
- Building Act: Act No. 183/2006 Coll., on Spatial Planning and Building Regulations (Building Act). This law includes aspects of spatial planning and building regulations relevant to the permitting of mining activities (Czech Construction Legislation, 2006).

In addition to these laws, there are several decrees and government regulations specifying detailed technical and administrative procedures for various aspects of mining activities, such as Decree No. 239/1998 Coll., on Details to Ensure Health and Safety Protection at Work and Safety of Operations in Mining Activities and Activities Conducted in a Mining Manner. This decree specifies detailed requirements to ensure health and safety protection at work in mining activities and activities conducted in a mining manner (Czech Mining Safety Regulation, 1998). Government Regulation No. 22/1999 Coll. sets the conditions for providing subsidies for the remediation of environmental damage caused by past mining works. This regulation sets the conditions under which subsidies may be provided for the remediation of environmental damage caused by past mining works (Czech Government Regulation on Environmental Remediation, 1999).

The global growth of mining and processing of rare metals increases the risks associated with the expansion of mining into new territories. Binnemans et al. (2013) emphasise the importance of developments in innovation and technology that support sustainable mining to reduce its environmental impact. Tost et al. (2018) highlight the

necessity of complying with international agreements, such as the Paris Agreement (UN FCCC, 2015), and ensuring that the expansion of mining aligns with societal expectations regarding environmental protection.

Research has predominantly focused on the technological, geological, and environmental dimensions of mining, while the social dimension remains frequently overlooked. This gap is evident even in new mining projects, where local resistance often stems from historical experiences and heightened environmental sensitivity (Wanger, 2011; Liu & Agusdinata, 2020). Furthermore, existing studies rarely integrate quantitative and qualitative methods in a way that would allow for a comprehensive understanding of stakeholder attitudes and expectations. There is a lack of deeper insight into how transparency and communication practices influence the social acceptability of mining. These elements are critical in determining whether a mining project is perceived as legitimate or contested (Entwistle et al., 2019).

Based on the theoretical and regulatory background, the research will focus on the following research questions:

- What are the expected economic, environmental and social impacts of lithium mining in the region?
- How might planned lithium mining disrupt local communities and natural ecosystems in terms of the attitudes of local actors?

The research questions address how lithium mining from the perspective of local actors may affect their attitudes and the sustainability of the development of the area, suggesting a potential conflict between industrial activities, economic benefits and conservation. The formulation of the questions highlights specific decision-making mechanisms and impacts, as it addresses regulatory and communication aspects that have a key influence on the decision to start lithium mining in the region.

## 2. Methodology

The research methodology aimed to map all stakeholders and take into account the environmental and social impacts, and in particular to assess regulatory mechanisms as they reflect the attitudes of municipalities and communities affected by lithium mining. This approach not only allows for an understanding of the current situation, but also for the formulation of recommendations for the future regulation and management of mining activities. Figure 1 shows the research methodology applied and depicts the set of methods and the need for a comprehensive and multidisciplinary approach to assess the environmental and economic impacts of starting lithium mining in the area.

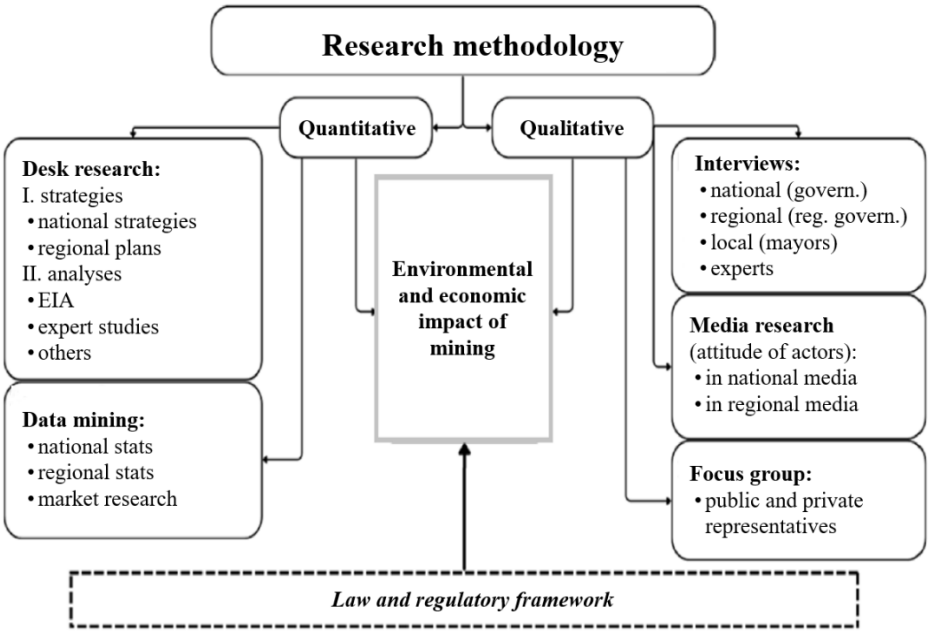


**Figure 1.** Research methodology

Quantitative research is based on desk research, the analysis of existing strategic documents, laws and expert studies. It examines both national strategies that determine the overall approach to lithium mining and its use in energy and industry and regional plans that focus on the specific impacts of mining at the level of regions and municipalities.

In addition to these strategic documents, the research utilises expert analyses, including EIA and expert evaluations of the economic aspects of mining, its effects on the labour market, and investment opportunities. Other important sources of information include studies mapping the socio-economic impacts of mining on local

populations and analyses of technological innovations in the mining sector.

An essential part of quantitative research is data mining, which focuses on analysing available statistical data. National and regional statistics related to employment, economic indicators, and the development of the lithium market are monitored. Market analyses then focus on global and local demand for lithium and developments in its price.

Qualitative research focuses on a deeper understanding of the social and political aspects of lithium mining. The primary method employed is conducting interviews with stakeholders at various levels - from national government and ministry representatives to regional administrations and mayors of municipalities directly affected by mining activities. The study also incorporates expert opinions from geologists, ecologists, and economists who provide independent professional assessments of the mining project.

The semi-structured interviews were designed and conducted in accordance with the principles outlined by Kvale & Brinkmann (2009), focusing on eliciting context-rich, actor-specific perspectives. An interview guide was developed covering key themes aligned with the research questions. Thematic analysis, as described by Braun & Clarke (2006), was used to analyse the interview transcripts, enabling the identification of recurrent narratives, divergences in perceptions, and institutional framings of lithium mining. This approach enabled the identification of patterns of meaning across stakeholder narratives while allowing for contextual interpretation. Themes were developed inductively through iterative reading, coding, and refinement of the data.

A significant component of qualitative research is media analysis, which examines the perspectives of key stakeholders as presented in national and regional media. This analysis explores how lithium mining-related topics are communicated to the public, the dominant narratives in media discourse, and the positions of political representatives. Another essential element of qualitative research is a survey conducted among residents of regions where lithium mining is planned. This survey aims to gather public opinions, concerns, and perceived benefits associated with the mining project. The findings offer critical insights into the attitudes of local communities and help identify key issues that need to be addressed in relation to lithium extraction.

The research is framed within a broader legal and regulatory context, which significantly influences decision-making regarding the future of lithium mining. Legal regulations and policy measures impact both the environmental aspects of mining and its economic consequences for the region. Therefore, the study includes an analysis of current legislation and its practical application, focusing on whether legal norms provide adequate protection for the environment and local communities.

By combining quantitative and qualitative methods, the research provides a comprehensive perspective on the issue of lithium mining. The integration of statistical data, expert studies, interviews, media analysis, and public surveys ensures a balanced assessment of the impacts of lithium mining, offering a foundation for the development of effective strategies and recommendations. This integrated approach not only enables the identification of risks and benefits, but also the formulation of concrete measures to minimise adverse effects and maximise positive outcomes for the region and its inhabitants.

As part of the research, a series of interviews were conducted with key stakeholders who either influence decision-making regarding lithium mining or are directly affected by these plans. Respondents were categorised based on their role and level of authority, allowing for a diverse range of perspectives on the issue. Political representatives at a national level (NUTS 1) included five interviews with members of the Czech government, specifically representatives from the Ministry of Industry and Trade, the Ministry of Agriculture, the Energy Regulatory Office Council, the University of Ostrava, and the Technology Agency of the Czech Republic. These respondents provided insights into the legislative framework, strategic plans, and regulatory possibilities for lithium mining from the perspective of state administration. At a regional level (NUTS 3), an interview was conducted with the governor of the Ústí nad Labem region, focusing on the impact of lithium mining on the regional economy, employment, and sustainable development. At a local level (LAU 2), three mayors from municipalities directly affected by the planned mining operations were interviewed. These local government representatives discussed anticipated environmental and quality-of-life impacts, as well as public attitudes toward the project.

Perspectives from the private sector were also incorporated through an interview conducted at the NUTS 3 regional level with a licensed lithium exploration operator. This stakeholder offered an economic perspective on the project, addressing the investment context, potential technological applications, and prospects for future mining development. In parallel, a structured survey was administered to 256 residents across multiple municipalities located near the proposed mining site. The survey yielded a representative overview of local community attitudes, capturing both the anticipated benefits and prevailing concerns regarding the planned lithium extraction activities.

The combination of stakeholder interviews and public opinion surveys enabled the research to obtain a comprehensive overview of how different groups perceive lithium mining. The study reflects not only the political and economic aspects of the issue but also its social dimension, which is crucial for understanding the overall impact of mining on the region and its inhabitants. Each respondent participated in an in-depth interview, and their responses and experiences were systematically analysed. The research also included an evaluation of additional stakeholder perspectives based on published articles and media interviews. The objective was to achieve the most

comprehensive understanding of how responsible political representatives approach the issue.

Regional and local respondents were also asked about their opinions on the impacts of mining in the municipalities they represent and in the wider region. Mayors, in particular, provided objective assessments of their municipalities' conditions and the potential effects of mining on local communities.

To quantify public attitudes, we calculated a sustainability perception index (Iac index) for each category. Each response in the survey was rated on a five-point Likert scale, with values assigned as follows: "very positive" = +2, "somewhat positive" = +1, "neutral" = 0, "somewhat negative" = -1, and "very negative" = -2. For each of the six categories, the scores were added together across all 256 respondents and divided by the number of responses, resulting in an average sentiment score per category. These average scores were then multiplied by 100 to standardise the values for clearer presentation. The resulting Iac index values range from –100 (strongly negative perception) to +100 (strongly positive perception). The Iac Index assessed respondents' answers to questions related to the categories: a) environment, b) air quality, d) quality of life of residents, e) economic situation of the municipalities, f) number of workplaces. The results section of the survey then shows these values.

The findings of this study provide a holistic perspective on lithium mining, integrating legal, economic, environmental, and social considerations. By engaging diverse stakeholders, from government representatives to local communities, the research offers a well-rounded assessment of both the risks and opportunities associated with lithium extraction. The study contributes valuable insights for policymakers, investors, and local authorities, facilitating informed decision-making aimed at balancing economic benefits with environmental sustainability and social well-being.

## 3. Results

The lithium mining project at Cínovec is located in the Czech Republic on the border with Germany (Figure 2). The lithium mining area is shown in Figure 3. This site has been allocated the maximum possible support of 49 million EUR, which is the maximum funding available for each of the strategic projects in the Ústí region.

However, the total cost of this project exceeds approximately 0.5 billion USD. The actual recognition of the possibility of lithium mining as a strategic investment has not yet been decided and is not mentioned in regional strategic documents. The only document that deals with this is the Transformation Plan of the Ústí region, which talks generally about lithium mining in the context of possible opportunities for transforming the economy of the region.

As a part of the social, environmental and economic impact assessment, it is necessary to carefully assess the potential impacts of planned lithium mining. If we focus on the individual impacts that will arise from the construction of the deep mine or the mining itself, a study assessing the potential impact on forest ecosystems will be necessary. The EIA will assess the occurrence of species in the project area with proposed measures for endangered species. Within the NATURA 2000 system of protected areas of European importance, the "Eastern Ore Mountains Bird Area" could potentially be affected.

Table 1 provides an overview of the main impacts of planned lithium mining and the corresponding studies required for their assessment. It addresses environmental, climatic, noise, socio-economic, and landscape aspects, with each category supported by specific expert analyses.

The first area of concern is the impact on fauna, flora, and ecosystems. The planned mining operations will take place in a region that includes significant landscape features such as forests and waterways, the disruption of which could have negative ecological consequences. Therefore, an expert study assessing the impact of mining on ecosystems is required. This analysis should evaluate the extent and nature of changes in local habitats, potential threats to protected species, and propose measures to minimise negative effects.


**Figure 2.** Location of the mining area in the Czech Republic

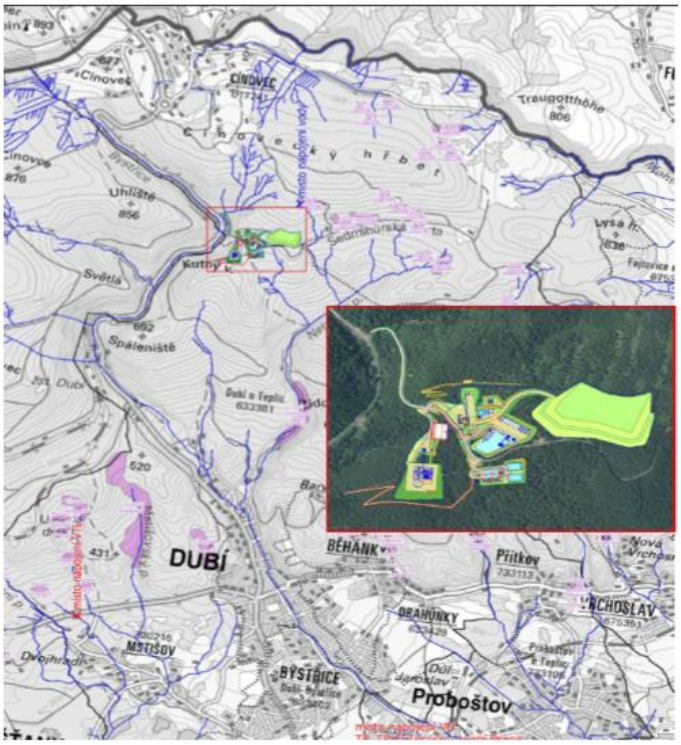


**Figure 3.** Location of the lithium mining area（Ceske lithium, 2024)

**Table 1.** Impacts, their characteristics and required studies in the regulatory framework for the impact analysis of mining in Cínovec (Geomet, 2021)

| Type of Impact | Description of Impacts | Required Study |
|---|---|---|
| Impacts on fauna and flora, ecosystems | In the area of the project there are significant landscape elements - forests and watercourses, which will be directly affected by the project. | Expert study assessing impacts on ecosystems |
| Water impacts | Higher groundwater pumping and drainage of flooded parts of the mine. | Expert study establishing conditions for the discharge of mine water |
| Climate and air impacts | Expected impact on air quality, especially in the mining area. | Dispersion study and facilities with dust control measures |
| Noise situation impacts | Noise will be more significant during the construction phase, with limited impact during mining due to the location of noise sources being underground. | Noise study to evaluate the expected noise situation |
| Landscape impacts | Changes to the appearance of the landscape caused by the construction of the main plant. | Expert study for landscape impact assessment |
| Social and economic impacts | Beneficial effects on the economy - fees, employment and development of new sectors. | Socio-economic impact assessment of mining |

Another key factor is the impact on water resources. Mining requires intensive water use, which is expected to lead to increased groundwater extraction and drainage of flooded sections of the mine. This could affect both the quality and quantity of water available in the region, necessitating a study to determine the conditions for mine water discharge. Such an analysis should specify how mining will impact the water balance and propose ways to minimise contamination risks.

In addition to impacts on water resources, the table highlights effects on climate and air quality. Mining and associated industrial activities could significantly contribute to dust emissions and air pollution, particularly around the mining site. Therefore, a dispersion study and dust control measures are required. This study will assess the potential impact on air quality and recommend technologies to help reduce pollution levels.

Another important category is noise pollution. The highest noise levels are expected during the construction phase when the mine and infrastructure are being prepared. During the actual mining process, the primary noise sources will be located underground, which should partially mitigate their impact. Nonetheless, a noise impact assessment is required to evaluate the expected noise burden and possible regulatory measures.

Lithium mining will also affect the landscape, particularly due to the construction of the main processing plant and its associated infrastructure. Changes in the appearance of the landscape could have long-term aesthetic and

ecological impacts, making a landscape impact study necessary. This analysis should determine how mining will alter the visual character of the region and whether compensatory measures, such as land reclamation after mining operations cease, are feasible.

The final factor mentioned in the table is the socio-economic impact of mining. This includes both positive aspects, such as job creation and economic benefits for the region, and potential negative consequences, such as disruption to the traditional way of life in local communities. The site is located away from residential developments and therefore no significant adverse impacts are anticipated. Among the social and economic impacts, the project has the potential to contribute to the development of an entire sector of the country's economy focused on sustainable mobility and low-emission energy, as well as create direct and downstream jobs in the region. A socio-economic analysis of mining is required to evaluate the benefits and risks from the perspective of local economic stability and social cohesion.

It can be concluded that the environmental and social consequences of mining cannot be assessed in isolation but require a comprehensive approach that integrates ecological, economic, and community aspects.

### 3.1 Survey Results

The survey aimed to determine residents' attitudes towards lithium mining in this area. According to local residents, lithium mining will have a rather negative impact on the development of the region, with less than 23% positive responses (Figure 4). It is also interesting to note that 17.1% of respondents answered "don't know", indicating a certain level of uncertainty or lack of information about the potential impacts of mining on regional development. The results show a significant level of public concern and scepticism about the potential impacts of lithium mining. Local citizens also responded similarly to the question of whether lithium mining should actually take place. On the other hand, according to a statement by the prime minister, the government is doing everything possible to allow lithium mining to start. Interviews with political leaders in the region revealed that they do not want to see the raw material merely extracted without further processing in the value chain.

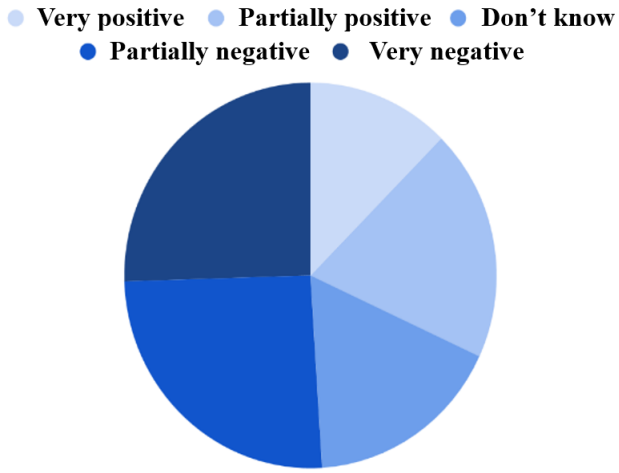


**Figure 4.** The impact of lithium mining on regional development from the point of view of locals

Respondents expressed a strongly negative stance on the impacts of lithium mining on the landscape, environment, air quality, and overall quality of life (Figure 4). The prevailing negative assessments indicate concerns among respondents about potential environmental degradation and a decline in living standards.

On the other hand, a positive aspect is that respondents generally viewed the economic impact on the municipality and job creation as predominantly positive. However, it is interesting to note that despite recognising the economic benefits, the prevailing stance among respondents remains neutral. The public expressed concerns about the negative environmental and quality-of-life impacts of lithium mining while simultaneously acknowledging its potential economic advantages.

Figure 5 shows public perceptions of the environmental, social, and economic aspects of lithium mining planned in the region.

The analysis of the results highlights a significant polarisation of opinions among respondents, with different categories of impacts being perceived with varying degrees of positive and negative sentiment.

The most pronounced negative assessments pertain to the impact on the landscape, environment, and air quality. A significant portion of respondents perceive the planned mining as a factor leading to potential landscape degradation, ecosystem disruption, and increased environmental burden in the region. These concerns reflect the broader discourse on the negative externalities of the mining industry, which include deforestation, soil and water

contamination (both surface and groundwater), and air pollution. The high proportion of negative responses in these categories suggests that the environmental dimension of the project is a key determinant of public attitudes toward mining.

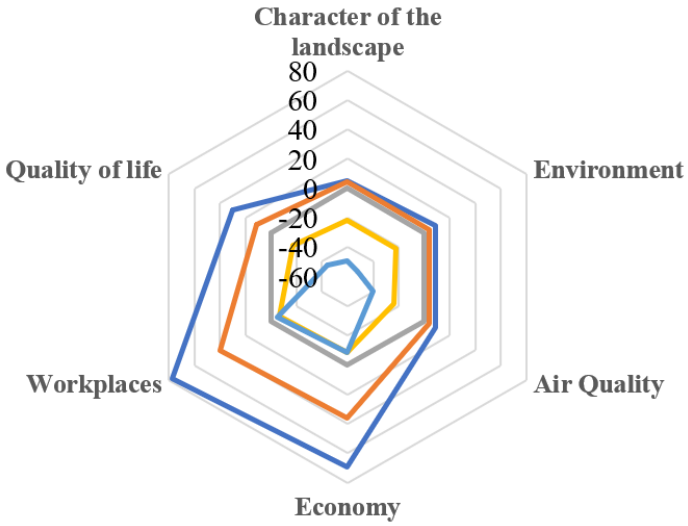


**Figure 5.** Local residents' attitudes towards the impact of lithium mining in various categories

Conversely, the economic impacts, including potential job creation and local economic development, are predominantly viewed positively. Expectations of economic benefits stem from the assumption that mining will generate new employment opportunities and stimulate the growth of related industrial sectors. This trend aligns with previous studies on the effects of the mining sector on regional economies, which confirm its capacity to drive job creation and investment opportunities. However, it is evident that economic optimism is accompanied by a certain degree of scepticism among some respondents, possibly due to uncertainties regarding the fair distribution of economic benefits within the local community.

An important finding is the relatively high percentage of respondents who expressed a neutral stance or indicated a lack of knowledge about lithium mining issues. This aspect suggests a shortage of information among the public and points to a low level of citizen engagement in decision-making processes related to the planned mining project. This uncertainty may stem from the absence of clearly defined communication strategies between local governments, investors, and residents, a factor that, according to available literature, often determines the success of mining project implementation in similar socio-environmental contexts.

Based on the attitudes of the residents, an aggregate index of attitudes (Iac) was calculated to compare how the different categories surveyed are rated overall. These results are shown in Table 2.

**Table 2.** The impact of lithium mining on these categories (Iac) according to local attitudes

| Category | Value |
|---|---|
| Landscape character | -61.6 |
| Environment | -61.4 |
| Air quality | -50.6 |
| Quality of life of residents | -20.0 |
| Economic situation of municipalities | +87.9 |
| Number of workplaces | +105.8 |

The values in the table clearly indicate that the impacts on landscape character (-61.6), the environment (-61.4), and air quality (-50.6) are perceived as significantly negative by residents. Such low scores suggest that the prevailing attitude among respondents reflects concerns about the degradation of the natural ecosystem, visual changes to the landscape, and potential air pollution associated with mining processes. These findings align with widely discussed environmental externalities of the mining industry, including deforestation, contamination of water resources, and increased dust pollution in affected areas.

The high level of negative assessments in these categories further indicates that residents primarily perceive lithium mining as an environmental threat. This perception may be linked to past experiences with industrial activities in the region or a lack of awareness regarding specific mitigation measures. This trend underscores the need for effective environmental regulation and participatory planning, which could help alleviate public concerns and increase project acceptance.

An interesting finding is the aggregated score related to residents' quality of life (-20.1), which, while negative, is less pronounced than for environmental factors. This suggests that although residents perceive mining as a potential threat to living conditions in the region, the degree of negativity is lower compared to its impact on the landscape and ecosystems. This relatively less critical stance may be influenced by expectations of economic benefits, which could compensate for environmental losses, such as through increased job availability or regional investments.

This assumption is confirmed by the positive values of economic impacts. The perception of the economic situation of municipalities (+87.9) and employment (+105.8) appears to be a dominant positive factor that offsets the generally negative attitude towards the environmental aspects of mining. Residents likely expect that the project will strengthen the local economy and create job opportunities, which can be interpreted as a significant argument for accepting mining, provided that ecological risks are adequately mitigated.

## 4. Discussion

The negative perception of landscape and ecological impacts suggests that the successful implementation of lithium mining in the region will require comprehensive environmental measures to minimise ecological damage while effectively communicating the benefits of mining to the public. At the same time, the positive scores in economic categories confirm that the potential of mining for regional development could serve as a key argument in negotiations with stakeholders.

In response to these challenges, a transition towards multi-level governance is suggested (Liesbet & Gary, 2003), which is identified as a flexible framework for engaging a wide range of actors and considering both local and global perspectives. Latapí Agudelo et al. (2019) emphasise the importance of an integrated approach to managing the impacts of mining operations, reflecting the polycentric approach (Ostrom, 2010). This approach acknowledges that effective adaptation to local specificities and successful management of common resources is possible without centralised intervention, as demonstrated by both historical and contemporary examples. Rockström et al. (2009) highlight the transgression of planetary boundaries, such as climate change, biodiversity loss, and alterations in the global nitrogen cycle, which increases the urgency to find a sustainable approach to lithium mining.

From the perspective of decision-making processes and public policy, it is therefore crucial to focus on mitigating environmental impacts while strengthening informational and participatory processes that enable residents to gain a better understanding of the real benefits and risks of the project. This approach could lead to greater acceptance of the mining plan and its effective implementation in line with sustainable development principles.

According to the findings of the research, the public perceives mining predominantly negatively, mainly due to concerns about landscape disruption, water pollution, and biodiversity loss. The integration of quantitative and qualitative methods in this study proved to be essential for a holistic understanding of local perceptions. While the quantitative survey offered a broad overview of residents' attitudes – highlighting overall scepticism about environmental impacts and moderate optimism regarding economic benefits – the qualitative interviews provided depth and nuance. Interviews with mayors, regional representatives, and other stakeholders revealed the institutional and historical contexts behind public concerns, such as mistrust stemming from past industrial activities or perceived exclusion from decision-making processes. The triangulation of these data sources helped confirm the coherence of findings while also uncovering contradictions, such as the gap between officially stated development goals and local scepticism about their implementation.

At the same time, there are expectations of economic benefits in the form of new jobs and investments in the region. This ambivalence highlights the need for more effective communication between government authorities, investors, and local communities. Therefore, the study examines strategies that could lead to greater transparency in decision-making processes and increased public involvement in the planning of mining activities.

## 5. Conclusion

Overall, the results confirm the significance of the environmental and social impacts of mining as a dominant element of public discourse, while economic benefits are often perceived as key factors in evaluation. The significant degree of uncertainty in respondents' answers highlights the need for increased transparency in decision-making processes and the strengthening of dialogue between stakeholders. The successful implementation of lithium mining in the region will therefore depend not only on the effectiveness of environmental regulatory measures but also on the ability of political and industrial actors to better communicate the potential benefits and risks of the project to the wider public.

This approach is not only a matter of sustainable development but also of ensuring social and political consensus to prevent the polarisation of public attitudes towards lithium mining.

There are several research limitations that need to be considered. One of the main limitations is the geographical specificity of the research - it focuses primarily on the Cínovec area, meaning that its conclusions may not be fully

applicable to other locations with different conditions. Another limitation is the temporal constraint of the data. Regulations, public opinion, and technological advancements are constantly evolving, and some conclusions may need to be revised in the future.

A significant challenge is also the subjectivity of how mining impacts are perceived. The attitudes of local communities may be influenced by both the media portrayal of mining and historical experiences with industrial activities in the region. Additionally, there are limitations in the availability of economic data - while the study assesses the potential economic benefits of mining, the available information on specific investments, project profitability, and regional economic impact remains incomplete. Furthermore, the study primarily focused on regulatory and social aspects, while a more in-depth technological analysis of innovative mining methods that could minimise environmental impacts was not thoroughly developed.

Given these limitations, several recommendations for further research arise. First and foremost, long-term monitoring of mining impacts should be conducted if the project is implemented. This includes the regular monitoring of water quality, biodiversity, employment changes, and regional economic development. Another important step would be a comparative study analysing experiences from other mining regions to identify key factors influencing the success and sustainability of mining projects.

At the same time, more attention should be given to technological innovations in lithium mining and processing. Future research should examine, for instance, methods of direct lithium extraction and advanced recycling technologies that could reduce the need for new mining operations. Additionally, deeper economic analyses should be conducted, focusing on evaluating the impacts of similar projects with an emphasis on assessing regional benefits, the involvement of local businesses, the effects on local municipalities and communities, and the environmental consequences.

Since the attitudes of local communities play a crucial role in the success of a mining project, it is essential to conduct ongoing research to track changes in public opinion at different stages of mining and to evaluate the effectiveness of communication strategies directed at local residents. Finally, future research should also take into account the broader geopolitical and energy context, particularly how domestic lithium mining could contribute to the energy security of the Czech Republic and reduce dependence on the import of strategic raw materials.

Overall, lithium mining requires a comprehensive approach that integrates environmental, economic, technological, and social aspects. Only in this way can a sustainable strategy be developed for utilising this resource while minimising negative impacts on regional development and the environment.

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**Data Availability**

The data used to support the research findings are available from the corresponding author upon request.

**Conflicts of Interest**

The authors declare no conflict of interest.

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