Lithium Reserves In Reasi District, J&K: Advantages And Disadvantages, A Geographic-Economical Analysis

Harsh Raj Yadav[1], Adarsh Kumar Yadav[2]

[1 *,2]Research Scholar, Dept. of Geography, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur UP.

***Corresponding Author:** Harsh Raj Yadav
[*]Research Scholar, Dept. of Geography, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur UP.

Abstract: This study examines the benefits and drawbacks of the lithium deposits recently found in Jammu and Kashmir's Reasi District through a thorough geographic-economic analysis. Because of its possible economic importance, lithium, an essential component for a number of sectors like electronics, renewable energy, and electric cars, has attracted a lot of interest. This research assesses the geographic distribution and economic potential of lithium deposits in Reasi District using a mix of geospatial analysis and economic modeling. The benefits of lithium discovery and exploitation—such as increased industry, employment, and income—are compared to the drawbacks, which include resource management difficulties, socioeconomic effects, and environmental deterioration. The study also looks at ways to lessen the negative impacts of lithium mining and exploitation, such as community involvement, environmental impact assessments, sustainable mining methods, and regulatory frameworks. This research intends to educate policymakers, industry stakeholders, and local populations about the potential and problems associated with lithium exploration and exploitation in the region by offering insights into the spatial and economic characteristics of lithium deposits in Reasi District.

Keywords: lithium, electronics, renewable energy, exploitation, community involvement, impact assessments.

Introduction:

Recently Ministry of Mines, India announced 6 million tonnes deposit of Lithium in Reasi district of Jammu and Kashmir, nowadays as the Lithium is called as 'White Gold' because from the mobile battery to any device which is electrical or powered by a battery lithium is the crucial component for the battery and thus it became a valuable resource in past few years. If the estimates will be accurate in quantity then India will be a leading reserve country of Lithium with second position in the world in the terms of lithium reserves. Although such reserves are estimated to be found in India but the economic viability of the extraction for country will clear the image more crystal.

Let us make it clear that today Lithium is most valuable resource for a country, in a smartphone either Lithium-ion batteries or Lithium-polymer batteries are used and vehicular batteries are also based on aforementioned batteries because in comparison to Lead acid battery Lithium batteries have 10 times longer life span and 60% lighter than lead acid and efficiency is also no doubt higher than any other prevailing technology beside this Lithium is also used in the power grid batteries to store electricity.

In India, almost Rs.88 billion worth of Lithium batteries and Rs.1.7 billion worth of lithium metal was imported from various countries in 2020-2021. The global Lithium market size was valued at $7.1 billion in 2021 and it is expected to reach a value of $15.45 Billion by 2028 at a Compound Annual Growth Rate (CAGR) of 11.75% for the forecast period of 2022-2028. As the people are moving away from fossil fuel driven vehicle towards electric vehicles and as solar and wind energy are used more, replacing coal thermal power plants we will certainly see a higher demand of lithium.

As the world transitions towards sustainable energy sources, the demand for lithium has escalated, accentuating the importance of identifying and evaluating viable lithium reserves. In this context, the Reasi District of Jammu and Kashmir emerges as a potential frontier in the quest for lithium resources. Nestled amidst the majestic landscapes of the Himalayas, Reasi District presents a unique geological profile that hints at the presence of significant lithium deposits. This research paper undertakes a comprehensive exploration of the lithium reserves in Reasi District, with a specific focus on elucidating the advantages and disadvantages associated with their exploitation. Through a nuanced geographic and economic analysis, this study endeavours to shed light on the potential ramifications of harnessing lithium resources in this region.

The geographic dimension of this analysis delves into the spatial distribution of lithium reserves within Reasi District, leveraging geological surveys and mapping techniques to delineate potential extraction sites and ascertain the geological characteristics of the deposits. Concurrently, the economic facet of the analysis assesses the feasibility of lithium mining in Reasi District, scrutinizing factors such as investment requirements, revenue generation, and employment opportunities. While the extraction of lithium holds promise for bolstering regional development and advancing the transition towards clean energy, it also raises pertinent concerns regarding environmental sustainability and socio-economic equity.

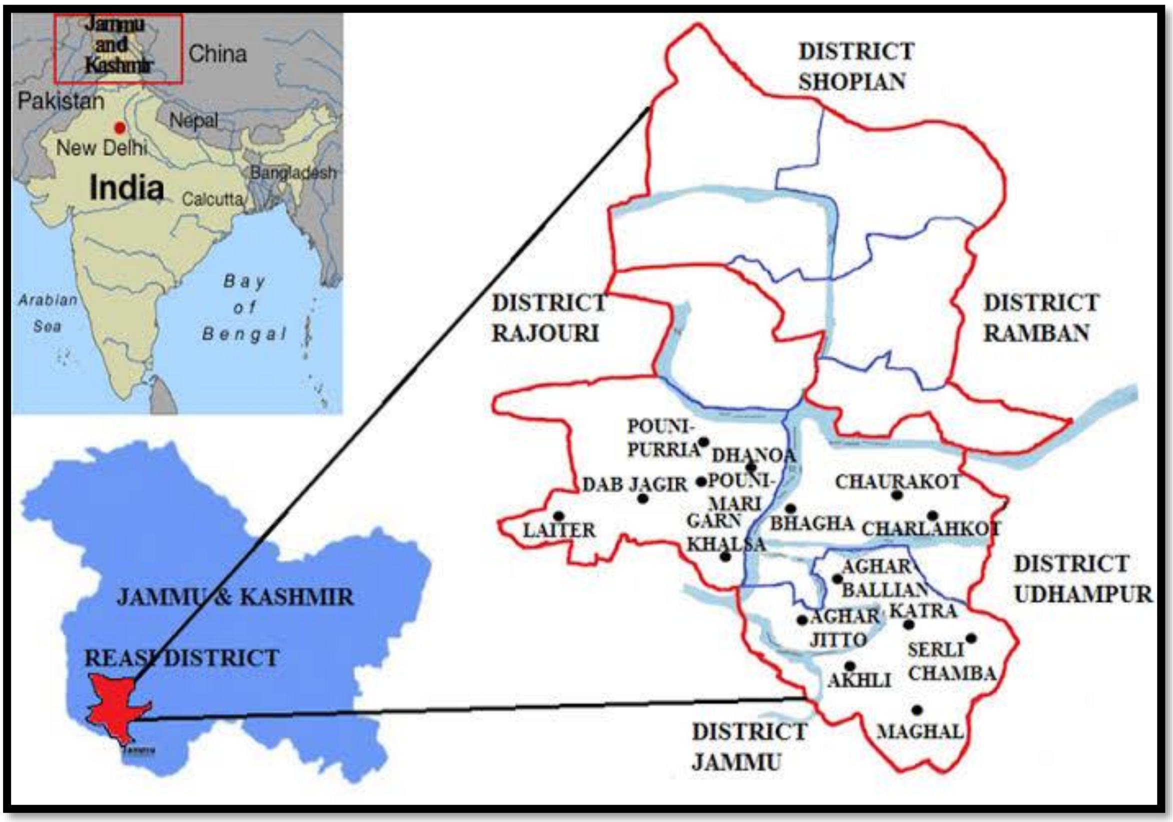
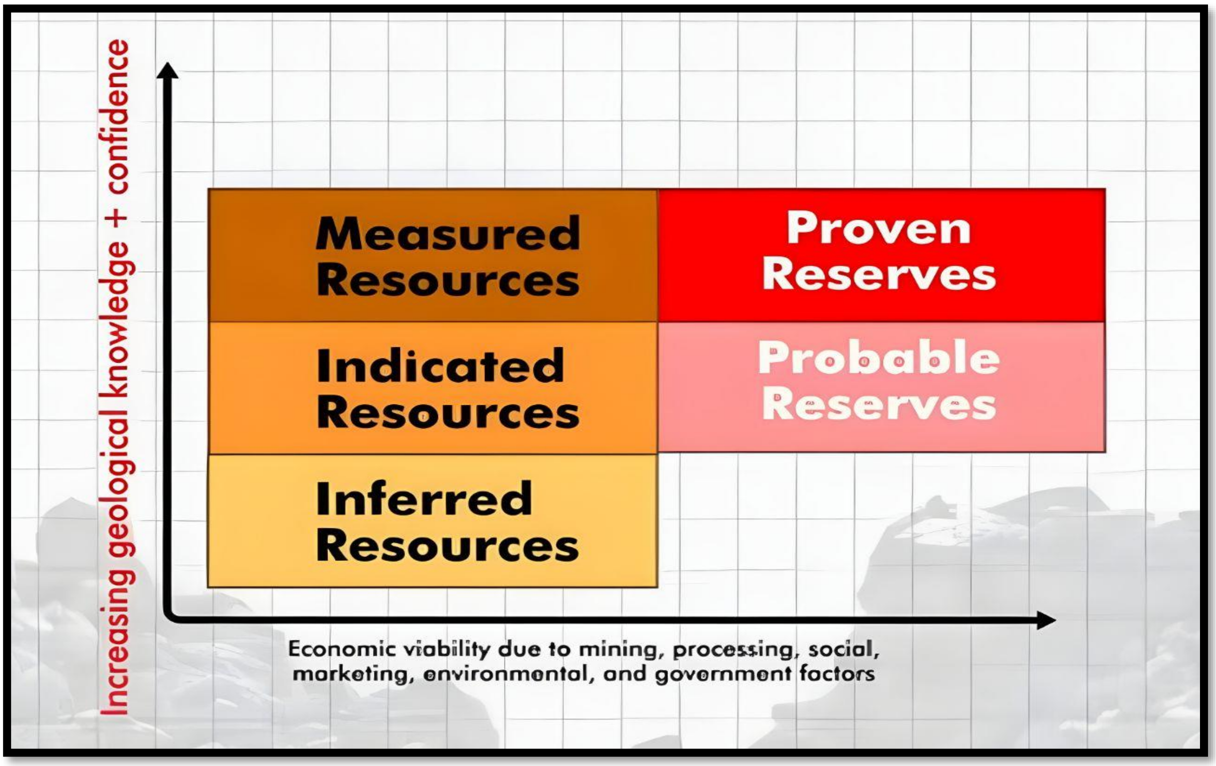


Figure 1: Location of Reasi District in J & K, India

The Lithium reserves discovered in Jammu and Kashmir have been categorised as Inferred resources i.e. resources whose quantity and quality can be estimated but we can't say for sure that how much Lithium reserves are actually present or the actual quality of the Lithium or whether it will be economically possible to mine it or not beside this environmental impact are not assessed yet because the hilly region of the Reasi District is more vulnerable to landslides

Figure 2: Share of Global Lithium-Ion Battery Manufacturing capacity in with a forecast for 2025 (Source: Statista)



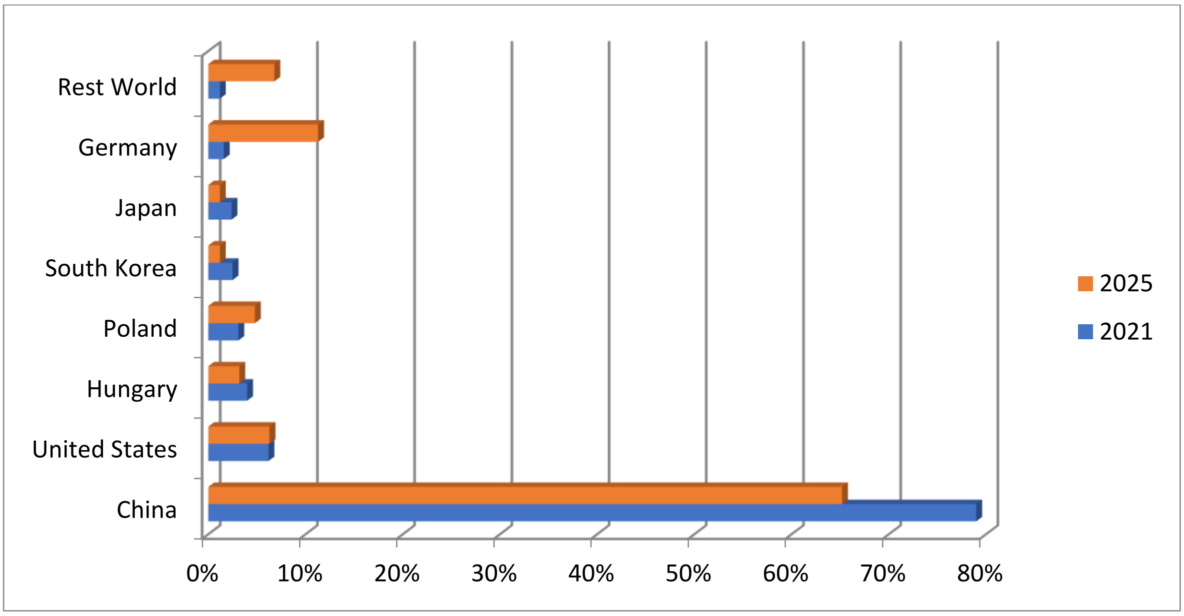
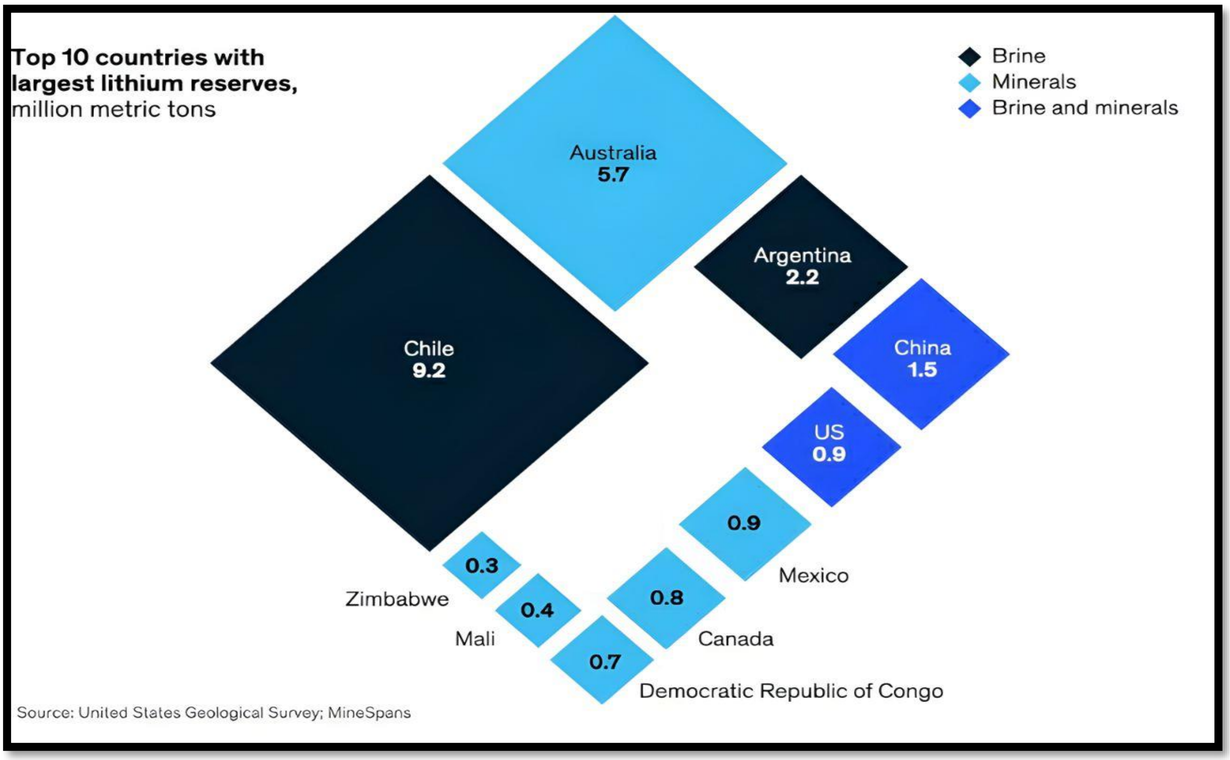


Figure 3: Types of Resources according to Economic Viability

On the top of Inferred resources there are the Indicated resources and then Measured resources, Proved resources and Probable resources. Y-axis represents the confidence about the knowledge of geological background of the region and X-axis shows the economic viability due to mining, processing, social, marketing environmental and government factors. The extraction will be all over feasible if either it will be a proven resource or measured resource because we'll have proper geological knowledge of that region with economic viability with low adverse environmental impact.
Types of Resources on the basis of utility:

Inferred Resources: A "inferred mineral resource" is a portion of a mineral resource for which amount, grade, or quality can be calculated based on geological evidence, sparse sampling, and a reasonably ascribed, but unconfirmed, geological and grade continuity. The estimate is based on sparse data and sampling taken from areas including outcrops, trenches, pits, workings, and drill holes using appropriate methodologies.

Figure 4: Top 10 countries with largest Lithium Reserves (in million metric tons)



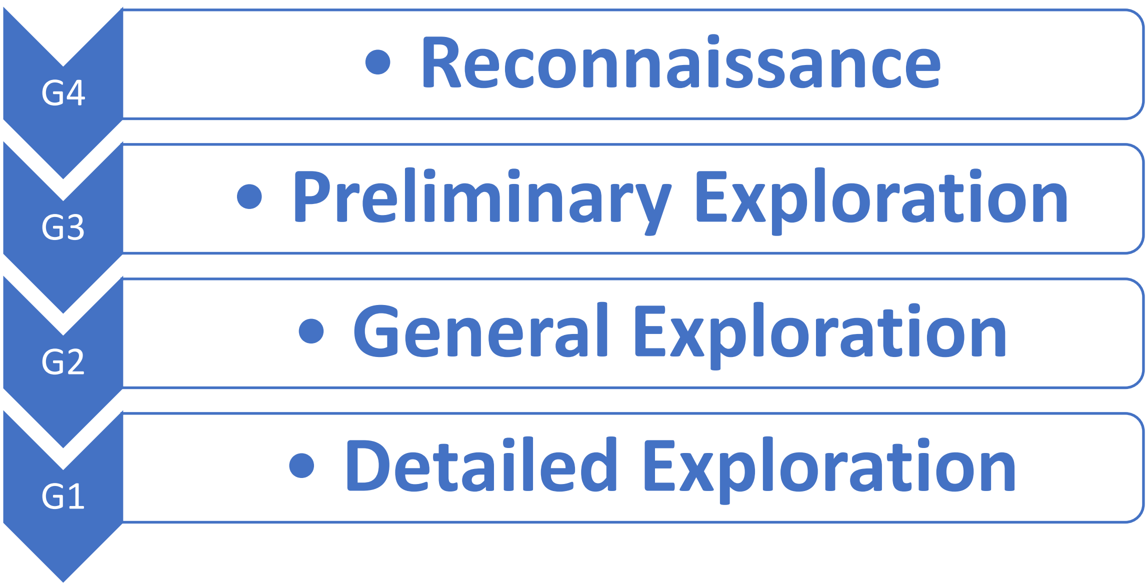
Indicated Resources: The word “Indicated Mineral Resource” describes a certain portion of a Mineral Resource for which quantity, grade or quality, densities, shapes, and physical characteristics can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters, to support mine planning, and to evaluate the economic viability of the deposit. The estimate is based on thorough and trustworthy exploration and testing data collected using the proper methods from locations such outcrops, trenches, pits, workings, and drill holes that are sufficiently spaced apart to allow for the reasonable assumption of geological and grade continuity.

Proved Resources: A "Proven Mineral Reserve" is the portion of a Measured Mineral Resource that can be economically mined, as shown by at least a preliminary feasibility study. This study needs to include enough data on mining, processing, metallurgical, economic, and other pertinent aspects that show that economic extraction is justifiable at the time of reporting.

Probable Resources: The term “Probable Mineral Reserve” refers to the portion of an indicated mineral resource—or, in certain cases, a measured mineral resource—that can be economically mined, as shown by at least a preliminary feasibility study. This study needs to include enough data on mining, processing, metallurgical, economic, and other pertinent aspects that show that economic extraction is justifiable at the time of reporting.
The Geological Survey of India has put these reserves into G3 category of initial assessment that is Preliminary Exploration Stage which is the second of a four step process according to the Mines and Minerals (Development and Exploration) Act, 1957.
The United Nations Framework Classification for Resources (UNFC) is a classification system for resources that defines the environmental, socio-economic, and technological viability of resource development initiatives. The UNFC offers a standardised framework to describe the degree of confidence in the projected amounts. It is a system that can be used everywhere to categorise and assess energy and mineral resources. The United Nations Economic Commission of Europe (UNECE) endorsed it in 2004. Geological assessment is often done in phases with more and more specificity. Reconnaissance, prospecting, general exploration, and thorough exploration—the typical sequential stages of geological investigation—produce resource data with clearly delineated levels of geological assurance. The G4 stage is normally where the mineral extraction process starts. These four stages are therefore used as geological assessment categories in the classification.
The geological assessment has 4 stages (Bureau of Mines) are as follows:

1. Detailed Exploration (G1): Using samples from outcrops, trenches, boreholes, shafts, and tunnels, among other locations, full three-dimensional delineation of a known deposit is accomplished by detailed exploration. Grids for sampling are tightly spaced. In a way that allows the deposit's size, form, structure, grade, and other pertinent features to be precisely determined. Bulk sampling processing tests can be necessary. Detailed Exploration provides information that may be used to decide whether to perform a feasibility study.

2. General Exploration (G2): The first step in general exploration is to define a deposit that has been located. For a preliminary assessment of mineral amount, techniques such as surface mapping, widely spread sampling, trenching, and drilling are employed. quality (including, if necessary, laboratory-scale mineralogical testing) and restricted interpolation based on indirect research techniques. The goal is to identify a deposit's primary geological characteristics, provide a fair indication of continuity, and provide a preliminary assessment of the deposit's size, shape, structure, and grade. The level of precision need to be good enough for determining the necessity of a detailed exploration and feasibility study.



3. Preliminary Exploration (G3): The methodical process of identifying and sifting through regions with promising improved mineral potential in order to find a mineral deposit is known as preliminary exploration. The techniques used include indirect mapping, geological mapping, and outcrop identification. techniques like geochemical and geophysical research. There may be some limited drilling, sampling, and trenching done. Finding a deposit to be the focus of more investigation is the aim. Quantity estimates are derived by the analysis of geological, geophysical, and geochemical data.

4. Reconnaissance (G4): A reconnaissance study uses preliminary field inspection, aerial and indirect methods, regional geological mapping, findings from regional geological research, geological inference and extrapolation, and preliminary field inspection to identify regions with elevated mineral potential on a regional scale. Finding mineralized regions worthy of more research in order to discover deposits is the goal. Quantity estimates should only be established when there is enough information available, when it is feasible to draw comparisons with known deposits with comparable geological characteristics, and only then within an order of magnitude.The G3 stage is further categorised into a six-step process to extract Lithium from Salt-flat brines or Mineral ores is as following:
Stage 1: Geological Surveys: Mapping on a more extensive scale and linking prepared maps with a top grid. Assessment of lithology, structure, surface mineralisation, analysis of old workings etc.
Stage 2: Perform Geochemical sampling rock type wise, soil survey.
Stage 3: Detailed ground geophysical work and borehole logging.
Stage 4: Check the technicality of pits/trench to explore the mineralised zone and drill borehole spacing
Stage 5: Sampling for litho-geochemical from a well-known section, pit/trench and core sample
Stage 6: Petrographic and mineralogical studies: the combined study of rocks in thin sections and the chemistry, crystal structure and physical properties of the mineral constituents of rocks.

According to the Indian Bureau of Mines (IBM), apart from the thorough examination of the above-mentioned geological axis, the proposal to mine minerals also needs to be assessed from a feasibility point of view along with the prospects of economic viability. GSI set that there are some more need of research and studies to take it up to G2 and then G1 category. GSI has claimed that once they reach the category of Measured or Proven resource then they can be considered as mineable reserves and then only Ministry of Mines would be able to know the exact of lithium present but it will take almost 5 to 7 years before we can economically exploit it. (GSI, 2023) In 2021, similar exploration was done in Karnataka where preliminary survey on surface and sub surface by Atomic Minerals Directorate for Exploration and Research (AMD), a constituent unit of Department of Atomic Energy have shown presence of Lithium reserves of 1600 tonnes in Inferred category in Pegmatite of Marlaglla-Allapatna area in Mandy district of Karnataka. Here, although India has discovered 6 millions of lithium which is less than Chile (9.2 tonnes) and more than Australia (5.7 tonnes) so this exploration does not mean that India becomes the second largest deposit country in the world because the reserves are still categorised as Inferred resource. If we compare with this logic, Bolivia will be the largest Lithium reserve country in the world in the category of Inferred resources where 21 million tonnes Lithium is estimated.

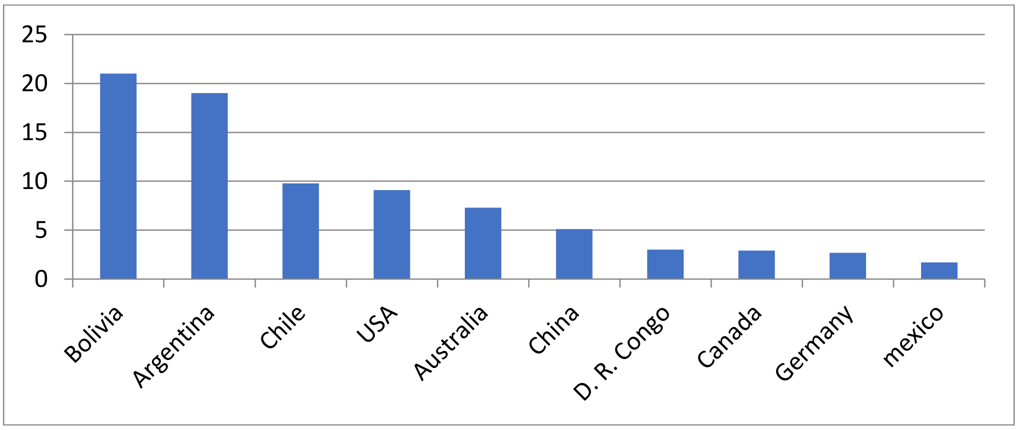


Figure 5: Lithium Resources Worldwide as of 2021 (in million metric tons)

The global known supply is at 89 million tonnes, even so this means that in India 5.5% of the global Lithium reserve are present which is a huge reserve found in a country. If the top player countries in the Lithium industry are compared then more than half of the global Lithium reserves are vested in only three South American countries i.e. Chile, Argentina and Bolivia whereas China is a leading producer of Lithium-ion batteries where approximately 75% of world's Lithium batteries are produced. According to recent study by International Energy Agency (IEA), China controls 58% of the Lithium processing industry, second spot is taken by Chile with 29% and Argentina with 10% globally. And with respect to lithium extraction Australia's share is highest with 52% followed by Chile with 22% and China with 13%(Fortune India, 2023). Notable interesting fact is that China has not discovered huge Lithium reserves in the country but processing industry of lithium in China is highest in the world due to giving more importance to the secondary sector of the economy. Obviously there is a high environmental cost of lithium mining. Similar to the mining of the other resources lithium mining causes environmental rupture and leads to water, soil and air pollution. Also the process of extracting lithium from its ore is a water intensive process. According to study approximately 2.2 million litres of water is needed to produce 1 ton of lithium metal (EuroNews.green). Beside this Lithium is often extracted from hard rocks and underground brine reservoir, if the government will ignore environmental impact then it can be a major cause for environmental degradation like Joshimath. It is true that Lithium is used to manufacture electric vehicles and electric batteries that is reducing the over all carbon emission but we cannot ignore the carbon emission produced from the mines. In countries like Argentina and Bolivia people have been protesting for the adverse

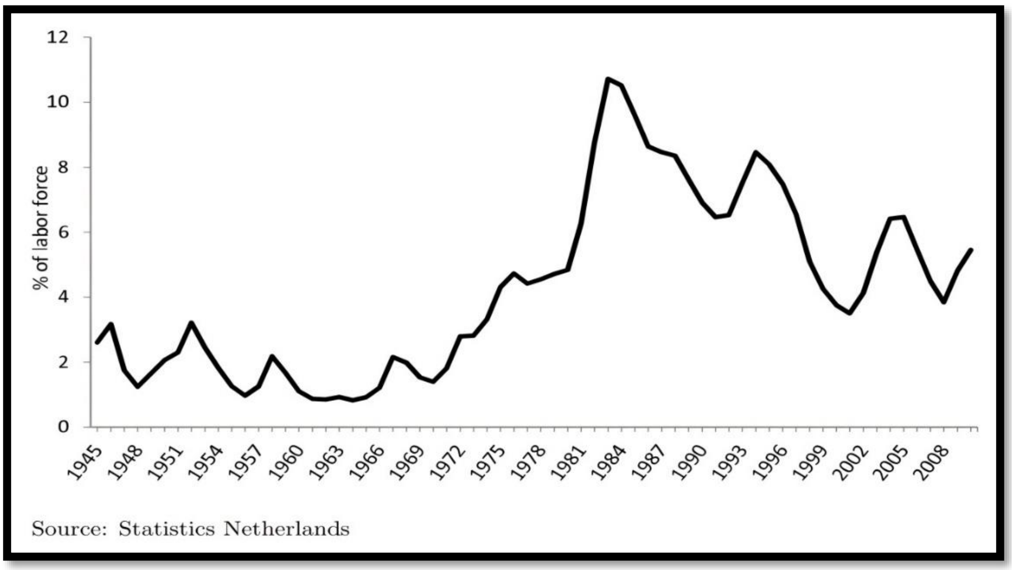
Figure 6: People of Bolivia and Argentina protesting against mining

environmental effect of lithium extraction.

Eventual Impacts on Indian economy:

Let us assume that 6 million tonnes reserve of lithium becomes Proven resources and economically profitable to mine them and haven't high adverse environmental impact then the situation of India in the world would we similar to that in the Gulf countries that hit the jackpot when they found petroleum. If we go to deep in history reactions of various industries can be seen when wholesome natural resources were found in any country. Some positive examples of this are Gulf countries, Norway, Australia and countries of Africa like Botswana and Rwanda which developed a lot due to those natural resources. But at the same time there are opposite and negative examples also, countries for whom their natural resources became a curse where the country had to face misfortune such as Democratic Republic of , Bolivia and Netherlands. The case of Netherlands is more interesting that the phenomena itself named after it that is "Dutch Disease". Dutch Disease also known as Resource Curse, a management that is often seen in the countries that have abundance of natural resources where it seems that country should become rich due to the natural resources but it doesn't happen anyway.

Figure 7: Rate of Employment in Netherlands before and after Gas Exploration



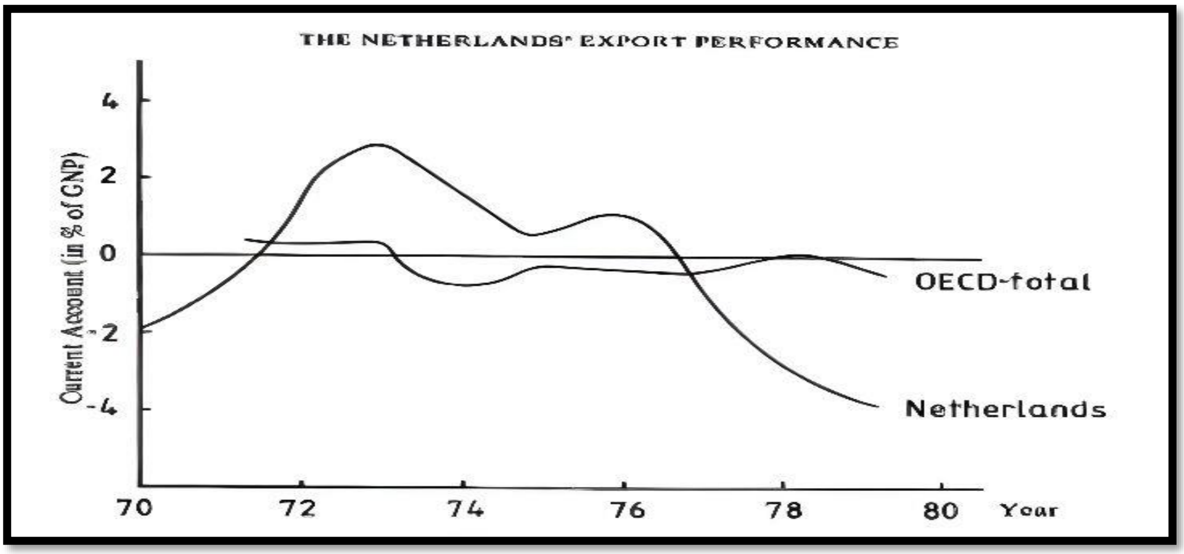
In 1977, The Economist magazine used the phrase Dutch Disease to explain the case of Netherlands because in 1959 large gas reserves were discovered in the Netherlands. Hence they started exploiting and exporting natural gas globally. In the early years it helped to boom the economy but later during 1970-1977 the unemployment rate increased up to 5.1% (US Bureau of Labour Statistics).

The impact of huge natural resource found can be seen in two ways:

A) When the country has high quantity of natural resources then the country starts exporting it to other countries of the world this means and inflow a foreign investment is coming in the parent country which leads to appreciation of country's currency price and making it stronger with respect to Dollar. If the value of nation's currency increases then the exporters of parent country who are exporting their product to other countries will suffer because everything that is being exported would become expensive.

B) This can be understood by the example that earlier if a foreign buyer who comes to the country to buy soft drinks then the exchange rate was $1=rupees 72 and he buys 6 bottle at 12 rupees each i.e. $1=6 bottles but after strengthening of the currency to $1=60rupees then the foreign buyer will get only 5 bottles which will lead to less export of the country or exporting the product will become more expensive and will negatively

Figure 8: Netherlands Export performance



effect the other sectors of the economy.

So in Netherlands they exported gas at mass level but their other industries such as exporting manufactured product became more costly and other industries couldn't survive their businesses.

C) Second impact can be seen on Labour market, when a natural resource in a country is discovered then the country will require labours for the mining activities, thus creating huge employment. Workers from other sectors will shift to the mining sector, leading to a devastating side-effect on manufacturing and service sector industries.

Conclusion: Overall we can conclude that Dutch Disease means, a country stumbling upon an abundance of natural resources and if the other sectors of the economy are not developed then they wouldn't be able to compete with the mining sector and will start falling down. Additionally the mining sector isn't very skill intensive, where a large amount of workers doesn't need prior knowledge so if there is a sudden shift of jobs to such sector then it will adversely impact the skill development and higher education among the masses of the country and will impact the long term growth of the country as well.

If we see the example of Gulf countries they avoided the phenomena of Dutch Disease easily because there were no other sectors than mining and extracting fossil fuel. The value of their currency was able to appreciate freely without any impact on any other economic sector because these countries were not exporting anything else. Other example in developed countries is Australia and Norway where natural resources are found abundantly and they avoided Dutch Disease masterfully among other sectors of economy. Norway's government spent on education of their citizens, public institutions were strong and economy was diversified, created proper infrastructure, provided high quality of life and did this work prior to the discovery of oil in 1969 and by then there was a strong democratic government in Norway.

Venezuela and Iran was not so fortunate because oil was found in Iran in 1908 and in Venezuela in 1922, in both countries other sectors were not developed people were not educated and all the funds and labour shifted to only a single sector that was oil mining and the entire country was forced to survive on only one resource and this lead to suffer heavy losses. Another way to avoid Dutch disease is to use the inflow funds from natural resources for the upliftment of quality of life of citizens. It should not be that only a handful of individuals become billionaires instead of it each citizen should get benefit of it. Norway followed it and it always stands on the top of HDI and other rankings related to quality of life. The easiest way would be to establish a Sovereign Wealth Fund which collects the access money from selling the natural resources and it can be used in diversifying the economy of the nation. Norway's sovereign wealth fund holds 1.2 trillion dollar in assets making it one of the largest fund (World Economic Forum, 2022).

The Gulf countries are paying a lot of attention to this lesson. Countries like UAE and Saudi Arabia that were once dependent on oil only, today they started to diversify their economy. Dubai has become a largest tourism hub, in fact non-oil sectors accounts for 95% of Dubai’s GDP (Gulf News, 2022) while UAE's economy have only 30% of GDP directly based on oil and Gas industries (International Trade Administration, 2022).

In the manufacturing of Lithium-ion battery Cobalt also plays a crucial role. Democratic Republic of Congo produced 74% of Cobalt mineral in 2021 (Cobalt market report, 2021). Only one country has such valuable resource should have lead Congo to have a good economy but the civil wars and the control over mines by war lords and Mafia have gave it a negative direction, child labour in mining can be seen everywhere in Congo and it nearly destroyed the ecological balance of the region, even then economy did not benefit at all.

If we do find a treasure of natural resources like Lithium we should not be dependent on it rather we need to use the resources to the enrichment of skills, development of human resources, diversifying the economy, building basic infrastructure, increasing literacy and higher education and developing service sector. The government should be mindful of things like corruption with the natural resource otherwise it will be proved detrimental to the country.

Exploration of lithium reserves in the Reasi, Jammu and Kashmir region has revealed both advantages and disadvantages associated with its exploration and exploitation. While the presence of lithium offers significant economic potential to the region, providing opportunities for industrial growth, job creation and income generation, it also presents challenges that must be carefully addressed. These include environmental issues such as habitat disturbance, water pollution and soil degradation, as well as socio-economic issues such as community displacement, unequal distribution of benefits and potential conflicts over ownership of natural resources. Therefore, all future efforts to extract and exploit lithium in the Reasi region must be guided by comprehensive strategies that prioritize sustainability, environmental protection, community involvement and equitable benefit sharing, ensuring that benefits are maximized and harms effectively mitigated. This approach not only optimizes the economic benefits of lithium reserves, but also protects the long-term well-being of both the environment and local communities.

To check the natural effect of mining and moderate the unfavourable impacts of lithium misuse in Reasi Area, a few measures can be implemented:

Environmental Impact Assessment (EIA): Conducting extensive EIAs before any mining activities, can help identify future environmental risks and to develop mitigation strategies. This involves assessing the impact on air and water quality/pollution, soil erosion in affected area, wildlife habitats rehabilitation and local ecosystems.

Adopting Sustainable Mining Practices: Implementing environment friendly mining techniques such as selective extraction, land reclamation process, and minimal surface disturbance. These techniques can minimize the ecological footprint of mining operations.

Water Management: Implementing water management planning to reduce water usage and exploitation, prevent contamination of water sources from hazardous chemical runoff, and properly treat wastewater in the mine before discharging in rivers or other water sources can help preserve local water resources and prevent water pollution.

Rehabilitation and Restoration: Developing plans for post-mining rehabilitation of displaced population and wild animals and restoration of disturbed areas, including soil stabilization, reforestation, and habitat restoration of wildlife can help mitigate the long-term environmental impacts of mining activities in this region.

Community Engagement and Consultation: Involving local communities in decision-making processes for mining, and addressing their problems, concerns and perspectives taking into account, can help build trust in people, minimize social conflicts with govenment, and to promote sustainable development practices in Reasi district.

Regulatory Framework and Enforcement: Strengthening regulatory frameworks for mining activities of company, strictly enforcing environmental protection laws, and implementing regular monitoring and compliance mechanisms can ensure that mining operations adhere to environmental standard.

Technology and Innovation: Investing in research and development of innovative technologies of mining for more efficient and environment friendly and sustainable lithium extraction processes can help reduce the environmental footprint of mining operations in this region.

Corporate Social Responsibility (CSR): Sustainable development in the area can be aided by enticing mining corporations to embrace ethical business practices through CSR activities, such as capacity-building programs, environmental conservation projects, and community development initiatives.

it is feasible to reduce the negative environmental effects of lithium mining and exploitation in Reasi District while maximizing the positive economic effects and guaranteeing the long-term health of the local community and environment by putting these strategies into practice in a thorough and integrated manner.

References:

1. Jaskula, B.W. (2018). Lithium. U.S. Geological Survey Mineral Commodity Summaries. Retrieved from https://pubs.usgs.gov/periodicals/mcs2021/mcs2021-lithium.pdf
2. Narsimha, A., Gogoi, M., Kumar, M., & Khare, P. (2020). Lithium: A review of its sources, extraction, environmental impact and potential treatment technologies. Chemosphere, 264, 128522. https://doi.org/10.1016/j.chemosphere.2020.128522
3. Singh, A., Kumar, R., & Singh, P.K. (2019). Lithium-Ion Batteries: A Short Review. Environmental Chemistry Letters, 17(2), 575-591. https://doi.org/10.1007/s10311-019-00890-1
4. Ministry of New and Renewable Energy, Government of India. (2019). Policy for Development of Lithium-ion Battery Manufacturing Ecosystem in India. Retrieved from https://mnre.gov.in/sites/default/files/webform/notices/Policy-for-Development-of-Li-ion-Battery-Manufacturing-ecosystem.pdf
5. Pandey, P.C., & Singh, V.K. (2020). Prospect of Lithium in India: A Critical Review. Journal of Metallurgy and Materials Science, 62(2), 61-74. https://doi.org/10.1007/s12540-020-00718-2
6. United Nations Environment Programme. (2019). Recycling Rates of Metals: A Status Report. Retrieved from https://www.resourcepanel.org/reports/recycling-rates-metals-status-report
7. Department of Mining, Government of Jammu and Kashmir. (Year). Annual Report
8. International Council on Mining and Metals. (2018). Good Practice Guide: Indigenous Peoples and Mining. Retrieved from https://www.icmm.com/engb/publications/mining-and-indigenous-peoples
9. Ram, M., & Kaur, J. (2019). Environmental impact assessment (EIA) of lithium mining and processing: A review. Journal of Industrial Pollution Control, 35(1), 165-174. Retrieved from http://www.jipc.org.in/PDF/vol35issue1/35_1_165_174.pdf
10. Shukla, P.R., Dhar, S., Victor, D.G., et al. (2019). Access to Energy Services: India Country Report 2019. International Institute for Applied Systems Analysis (IIASA), Austria. Retrieved from http://pure.iiasa.ac.at/id/eprint/16397/
11. D'Agostino, V., & Chami, R. (2020). The socio-economic impacts of mining on local communities: Evidence from Africa. Resources Policy, 68, 101707. https://doi.org/10.1016/j.resourpol.2020.101707
12. Rytteri, E., & Hentinen, K. (2019). Economic geology. In R.W. Fairbridge (Ed.), Encyclopedia of Geology (Second Edition) (pp. 422-434). Academic Press. https://doi.org/10.1016/B978-0-12-409548-9.12045-3
13. Singh, R.P., Prasad, R., & Kumar, V. (2021). Impacts of mining on land use/land cover using remote sensing and GIS techniques: A case study of Reasi District, Jammu and Kashmir, India. Modeling Earth Systems and Environment, 7, 2573–2583. https://doi.org/10.1007/s40808-021-01147-6
14. United Nations Development Programme. (2019). Sustainable Development Goals Report for India 2019. Retrieved from https://www.in.undp.org/content/india/en/home/library/human_development/sdg-india-progress-report-2019.html
15. Rau, D. (2020). Socio-Economic Impact Assessment of Mining and Mining Policies on Local Livelihoods in the Context of Jammu & Kashmir: A Case Study of Reasi District. Thesis, University of Jammu, India.
16. https://ibm.gov.in/writereaddata/files/07042014175101unfc.pdf
17. https://www.statista.com/