India's Engagement with the Lithium Triangle Nations: Securing India's Lithium Needs

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India's Engagement with the Lithium Triangle Nations: Securing India's Lithium Needs

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Executive Summary

Introduction

India's rapid industrialization, growing population, and increasing energy demands have placed a significant emphasis on securing sustainable and clean energy sources. With the global shift towards renewable energy and the electrification of transportation, the importance of lithium as a key component in lithium-ion batteries has become paramount. The Lithium Triangle, comprising Argentina, Bolivia, and Chile, holds the world's largest lithium reserves and has emerged as a crucial region for lithium extraction and production.

Macroeconomic Scenario and Foreign Trade of Lithium Triangle

Argentina is the third largest economy in the Latin American and Caribbean (LAC) Region with a Gross Domestic Product (GDP) of approximately US$ 630.7 billion in 2022. Chile is a prosperous country in South America known for its strong economy and competitiveness. In 2022, Chile's GDP reached US$ 310.9 billion, making it the fourth-largest economy in Latin America and the Caribbean. Bolivia is a landlocked country located at the center of South America. It is the 14th largest in Latin America, with a GDP of around US$ 43.4 billion.

The merchandise trade of the Lithium Triangle region with the rest of the world witnessed a tremendous year-on-year growth of 44.1% and amounted to US$ 349.7 billion in 2021. Exports amounted to US$ 181.8 billion, while imports stood at US$ 167.9 billion, resulting in a trade surplus of US$ 13.9 billion for the region in 2021. The Lithium triangle has traditionally been a trade surplus region with only one yearly deficit in the last decade amounting to US$ 2.8 billion in 2017.

India-Lithium Triangle Bilateral Trade Relation

India's trade with the Lithium Triangle region has witnessed rapid growth in the past decade. Total trade almost doubled in 2021 to US$ 9.6 billion from US$ 4.9 billion in 2012. India's exports to Lithium Triangle were close to US$ 2.5 billion in 2021, up by over 56% over 2020 while imports stood at US$ 7.2 billion, an increase of 59% over the previous year.

India has emerged as a key supplier of imports and market for Lithium Triangle's exports during the last decade. India's share in Lithium Triangle's exports has more than doubled from 1.7% in 2011 to 3.9% in 2021. At the same time, the share of India's exports in Lithium Triangle region's total imports has also improved from just 0.6% in 2011 to 1.5% in 2021.

Argentina, Bolivia and Chile together constitute a key part of India's overall trade with the Latin America and Caribbean (LAC) region. The triad accounts for 13% of India's total exports to the region and 29.5% of the

region's total exports to India in 2020, indicative of flourishing economic relations between India and the Lithium Triangle region.

India's export basket to the Lithium Triangle is well diversified. India's top exports to Lithium Triangle consist of transport vehicles (HS-87), mineral fuels and oils and products of their distillation (HS-27), pharmaceutical products (HS-30), organic chemical (HS- 29), miscellaneous chemical products (HS-38) and iron and steel (HS-72), among others.

Enhancing trade with the Lithium Triangle countries holds a strategic importance for India as it seeks to secure reserves of critical minerals like lithium. Moreover, while trade with the three countries that constitute the Lithium Triangle has proliferated, it is characterized by a growing imbalance with India facing mounting trade deficit. It is important for India to recognize opportunities where Indian exports can fulfil the import demands of the lithium triangle region in order to create a more balanced and sustainable two-way exchange of goods.

Global Lithium Scenario

Mineral resources are naturally occurring concentrations of minerals or rock formations with potential economic value. They must be present in sufficient quantity to be worth extracting and processing. However, the presence of a viable resource alone doesn't guarantee extraction. Its economic potential is determined through a detailed evaluation process, including drilling and testing, to prove the quantity and quality of the deposit. Only then is it considered a mineral reserve, meeting geological, economic, and legal criteria. As per the US Geological Survey, the total estimated global resources of lithium were 98 million tons in 2022. The total identified lithium resources have increased by 10.1% from 89 million tonnes in 2021 as a result of continuing exploration across the world. The continental brine aquifers in the Andes Mountain ranges of South America located at a high altitude are the most abundant source of lithium-rich brine. The Salars or salt flats with lithium deposits are concentrated in three countries, Argentina, Bolivia and Chile which are collectively referred to as the Lithium Triangle that accounts for roughly 53.1% of the global lithium resources. Argentina has a number of salars with high lithium deposits including Salar de Muerto Hombre, Salar de Olaroz and Salar de Marianna and accounted for 20% of world lithium resources. Bolivia's Salar de Uyuni is estimated to be the largest reserve base of lithium in the world. Bolivia's total resources represent 21% of the world's total lithium resources. Chile's Salar de Atacama is currently the largest source of lithium production from brine in the world.

Lithium is extracted from lithium minerals found in igneous rocks composed of large crystals (spodumene) or in water with a high concentration of lithium carbonate (brine). World lithium reserves have increased from 22 million tons in 2021 to 26 million tons in 2022. In terms of lithium reserves, Chile accounted for the largest share of global reserves of lithium at 35.8% followed by Australia (23.8%), Argentina (10.4%) and China (7.7%) in 2022.

The global production of lithium in 2022 was estimated at 130,000 tons increasing by 21.5% as compared to 2021. The global production of Lithium has grown by an average of 15.1% between 2017 to 2022. Australia was the largest producer of lithium in 2022 accounting for a share of 46.9% in 2022 followed by Chile at 30%, China at 14.6%, and Argentina at 4.8%, respectively. Owing to the rapid increase in demand and prices of lithium in 2022, established lithium operations worldwide increased or were in the process of increasing production capacity. Chile is involved in processed lithium as well, though China dominates the production of processed and refined lithium products.

In 2022, the global consumption of lithium was estimated to be 134,000 tons which represented a 44.1% increase over 2021. A major proportion of lithium finds end-use in batteries with a share of 80%, followed by ceramics and glass (7%). Other sources of demand include use in lubricating greases (4%); continuous casting mold flux powders (2%); air treatment (1%); medical (1%) and other uses (5%). The share of lithium consumption for batteries has increased exponentially in the last decade as a result of expanding markets of electric vehicles and portable electronic devices that require rechargeable lithium batteries. Lithium-based batteries are also finding increasing application in electric tools and grid storage as well. It is observed that Lithium usage has increasingly shifted to batteries increasing from 46% in 2017 to 80% in 2022, respectively.

Lithium demand has almost doubled since 2017 to 80 kilotonnes (kt) in 2021, of which demand for EV batteries accounts for 47%, up from 36% in 2020 and only 20% in 2017. Lithium is also used in the production of ceramics, glass and lubricants. Batteries are now the dominant driver of demand for lithium and therefore set the price.

International Trade of Lithium

In the context of international trade, three main forms of lithium can be distinguished and defined at the global HS 6-digit subheading level. These are:

- Unprocessed Lithium – HS 253090
- Processed Lithium – HS 283691, HS 282520
- Refined Lithium Products – HS 282739, HS 282690, 280519

Unprocessed lithium refers to ores and concentrates of lithium. Trade in this product is characterized by the strong linkage between Australia and China, with Australia being the largest exporter accounting for a global share of 49.2% while China was the largest importer in 2021 accounting for a global share of 58.1%.

The unprocessed lithium exported from Australia to China is processed and refined and subsequently used in the manufacture of batteries designed for various applications. The unprocessed lithium is treated and concentrated into processed lithium chemicals which refer to intermediary forms of lithium like lithium carbonate and lithium hydroxide. These two compounds are used in creating cathode materials or for further processing to create battery electrolyte.

Chile is the largest supplier of lithium carbonates (HS-283691) with total exports of US$ 882.9 million in 2021 accounting for 72.8% of global exports of lithium carbonate. Bolivia was the 10th largest exporter in 2021 accounting for a share of 0.8%. China (36.8%), South Korea (25.2%) and Japan (13.6%) are the largest importers of lithium carbonates. India was the 10th largest importer of lithium carbonate (US$ 8.8 million) accounting for a share of 0.6% in 2021.

China is the largest exporter of lithium oxide and hydroxide (HS-282520), with exports of US$ 763.9 million in 2021, representing a global share of 68.6% in total exports. The US and Chile are next with share in total exports of 8.8% and 8.6% respectively followed by Russia with a share of 7.1%.

South Korea and Japan are the top importers with imports of US$ 667.0 million and US$ 388.7 million respectively, in 2021. The two together accounted for 83.6% of global lithium oxide and hydroxide imports in the world. India was the 4th largest importer of lithium oxide and hydroxide of amount US$ 24.1 million in 2021 accounting for a share of 1.9%.

Processed lithium chemical may require further treatment to yield specific refined lithium compounds which are ready for end-use. These include pure lithium metal, alloys or electrolyte solutions containing lithium. Lithium alloys are used in making cathode materials for Lithium Ion Batteries (LIBs) and lithium chloride is used in making electrolyte solutions which are the medium through which ion exchange occurs between the cathode and anode. Lithium hexafluorophosphate (LPF) (HS-282690) is the most commonly used lithium concentrate used in LIB elecrolytes.

Trade volumes in refined lithium compounds in the form of fluorine salts (HS-282690), chlorides (HS-282739) and as pure metal (HS-280519) is lower than those for unprocessed and processed lithium. This indicates that countries importing large quantities of unprocessed and processed lithium compounds refine these further for end-use. Thus, presumably, China, Japan and South Korea which are the largest importers are producing refined lithium as an input for their battery manufacturing industries. China, European Union, South Korea, United States and Japan are the largest exporters and importers of the product, indicating most of the final value addition in manufacture of LIBs is concentrated in these regions.

China is the largest processor and refiner of lithium compounds. This is a result of Chinese government's focus on subsidizing OEMs for fleet electrification and encouraging consumers to purchase electric vehicles which has allowed private firms to pursue aggressive expansion in all stages of lithium and LIB value chains. This is also reflected by the data of major exporters of refined lithium products (HS 282739, HS 282690 and HS 280519) where China is the largest exporter accounting for a global share of 15%, 49.2% and 45.4%, respectively. India accounted for 8.3% of global exports of lithium chloride. USA, countries of European Union, Republic of Korea were among the major importers of lithium chloride in 2021 whereas India accounted for 5.6% of global imports of lithium chloride during the same period.

Strategies for Securing India's Lithium Needs

India has set an ambitious target of attaining a capacity 500 GW of non-fossil fuels-based energy and reduce projected CO_2 emissions by 1 billion tons by 2030. Massive deployment of grid storage and sweeping uptake of electric vehicles will be essential for achieving these goals. In turn, the requirement for batteries to support this transition will be enormous. India currently has a negligible presence in the global supply chain for Advanced Cell Chemistry (ACC) technologies. However, India plans to fulfill its future requirements through the development of its domestic battery manufacturing ecosystem in line with its ambition of self-reliance in this sector. However, presently raw materials and technology are the major barriers to large scale manufacturing of Lithium-Ion batteries in India. The development of a domestic battery manufacturing ecosystem is crucial to achieving India's ambitious goal of electric mobilisation and 500 gigawatts (GW) of installed non-fossil fuel energy by 2030.

International Engagements

India is projected to require large supplies of lithium to achieve its battery manufacturing, electric mobility, energy storage and energy transition targets. India has been utilizing its diplomatic associations in other countries for collaborations in joint exploration activities for critical and strategic minerals.

Khanij Bidesh India Ltd. (KABIL) has been promoted as a joint venture of three Central Public Sector Enterprises, viz., National Aluminum Company Ltd. (NALCO), Hindustan Copper Ltd. (HCL) and Mineral Exploration Company Ltd. (MECL). It has been set up with the objective of ensuring a consistent supply of critical and strategic

minerals to the Indian domestic market. KABIL is set up to carry out identification, acquisition, exploration, development, mining and processing of strategic minerals overseas for commercial use and meeting domestic requirements. The minerals will be sources through creation of trading opportunities, government-to-government collaborations and strategic investments in exploration and mining assets of these minerals in source countries. Through a commissioned study, KABIL has identified 12 minerals where it seeks to promote international cooperation and build business partnerships. These are Lithium, Cobalt, Germanium, Indium, Beryllium, Niobium, Selenium, Gallium, Tantalum, Tungsten, Bismuth and Tin. Out of these 12, Lithium and Cobalt have been identified as being the most critical and strategic in nature.

Based on a commissioned study and selection criteria, select source countries have been shortlisted for exploring possibilities of mineral asset acquisition abroad. So far, engagements are underway with select source countries such as Australia, Argentina, Bolivia, Chile etc. which are endowed with the cited critical and strategic minerals specifically Lithium and Cobalt in hard rock formations as in Australia and Lithium as brine in the huge tract of Salars as in Latin American countries.

Domestic Exploration

Under the annual Field Season Program (FSP), the Geological Survey of India (GSI) has taken up 20 Lithium projects in the last five years in Andhra Pradesh, Arunachal Pradesh, Bihar, Chhattisgarh, Himachal Pradesh, Jharkhand, Jammu & Kashmir, Madhya Pradesh, Meghalaya, and Rajasthan. Under FSP 2022-23, GSI has taken up 18 Lithium projects in 6 states and 1 Union Territory. Geological Survey of India has for the first-time established Lithium inferred resources (G3) of 5.9 million tonnes in Salal-Haimana area of Reasi District of Jammu & Kashmir (UT).

Policy Recommendations

India's engagement with the Lithium Triangle nations has gained significant traction in recent years. As India strives to meet its increasing energy demands and transition towards a cleaner and more sustainable energy system, securing a stable supply of lithium has become a strategic priority.

Improving Trade Relations

India needs to evaluate the scope of bilateral PTAs with Argentina and Bolivia as well as the potential for an FTA with Chile. India also need to work on reducing shipping costs for its exports to South America. Logistics play a key role in determining trade flows and strengthening economic relations between the two regions. India needs to develop direct shipping services to the Latin American region in order to bypass transshipment hubs. It needs to develop its warehousing facilities in the region as well as build domestic shipping lines to reduce transaction costs.

Developing the Indian Mining Sector

Enhancing the resource base and reserves through exploration, building infrastructure, human capital and technological capabilities, and creating a robust information, education and communication strategy are essential for improving mining prospects of the country. A strong domestic private sector in the mining sector which is capable of undertaking large-scale risky investments is likely to be in a much better position in undertaking international lithium exploration and mining and ensuring that lowest-cost lithium is made available for domestic battery manufacturing requirements.

Creating a Minerals Knowledge Center

Currently the Indian Bureau of Mines publishes data related to only minerals which have considerable deposits located in India. It is important to build a repository of information that contains detailed information about domestic and international resources and reserves of such minerals.

Increasing Research and Development

The primary reason for the global race towards securing lithium is its requirement in the manufacturing of lithium-ion batteries. India currently does not possess significant domestic resources of lithium making it entirely import dependent. Therefore, in addition to acquisitions of international mining concessions, R&D efforts to optimize methods of extraction, concentration, separation and purification of minerals to increase yields and make supply more resilient. Investments in research and development of advanced battery technologies with higher energy densities and increased number of charge-discharge cycles will help India become more resource efficient. The Production Linked Incentive (PLI) scheme for National Programme on Advanced Chemistry Cell (ACC) Battery Storage is a right step as it incentivizes investments in such advanced lithium batteries as well as alternate chemistries.

Developing a Comprehensive Critical Resource Strategy

India has not yet developed a national policy for securing critical mineral supplies. It is essential to create a policy roadmap that charts an action plan taking into consideration where India's strengths and weakness lie in terms of critical mineral resources. An overarching framework is necessary to ensure that decisions follow a long-term vision and actions of various entities are synchronized to achieve national objectives. India's efforts at improving diplomatic ties with Lithium Triangle as well as the work of KABIL in acquiring mining interests in these countries should be integrated as part of a broad strategy that defines clear roles and expectations.

Capturing Value in Battery Supply Chains

India aims to be an important manufacturer of lithium-ion batteries, globally. In order to achieve this goal, it would require refined lithium compounds among other intermediate products used in the production of LIBs. Building domestic lithium processing and refining capabilities would be important in improving India's cost competitiveness as a supplier in global battery markets. Building such capabilities would provide raw material suppliers like Lithium Triangle with an alternative market and provide countries like Japan and South Korea an alternative source of supply for intermediate inputs.

Seeking Common Grounds

While reaching out to resource rich countries like Argentina, Bolivia and Chile, it is important to move beyond transactional ties and build relationships founded on shared national development goals. The two regions have a lot of shared interests in improving their energy securities. Similarly, Argentina and India both have underdeveloped mining sectors, and this raises possibilities in joint efforts towards exploration, research and development. With high levels of public debt, the development projects geared towards improving infrastructure are of critical importance to Bolivia.

Chapter

Lithium Triangle Countries: Macroeconomic Overview

India's rapid industrialization, growing population, and increasing energy demands have placed a significant emphasis on securing sustainable and clean energy sources. With the global shift towards renewable energy and the electrification of transportation, the importance of lithium as a key component in lithium-ion batteries has become paramount. The Lithium Triangle, comprising Argentina, Bolivia, and Chile, holds the world's largest lithium reserves and has emerged as a crucial region for lithium extraction and production.

In the early 2000s, India started exploring potential lithium sources and forging cooperation with lithium-producing nations. Argentina was one of the early partners, with India's Tata Chemicals signing a Memorandum of Understanding (MoU) with the Argentine government in 2009 to explore lithium resources and develop lithium-ion batteries. Bolivia possesses significant lithium reserves in its Salar de Uyuni salt flats. In 2011, the Indian government signed an MoU with Bolivia's state-owned lithium company, Yacimientos de Litio Bolivianos (YLB), to explore lithium deposits. The collaboration aimed to support Bolivia's efforts in lithium extraction and secure lithium supplies for India.

To ensure a stable lithium supply for India's growing demand, Indian companies began signing lithium supply agreements with Lithium Triangle countries. India has engaged in high-level diplomatic dialogues and visits with the Lithium Triangle countries to strengthen ties and explore strategic collaborations. In 2018, during the Indian Prime Minister's visit to Argentina, India signed several agreements, including one to promote lithium partnership. Indian companies have also invested in lithium projects in the Lithium Triangle countries to secure supply and establish a presence in the region.

India has been striving to develop a robust lithium-ion battery manufacturing ecosystem. Lithium Triangle countries, known for their lithium resources and expertise in battery production, have become significant partners. Joint ventures and collaborations have been established to facilitate technology transfer, develop lithium-ion battery manufacturing facilities, and promote electric vehicle adoption in India.

India has shown a commitment to sustainable resource management and social responsibility in its lithium engagements with the Lithium Triangle nations. Efforts have been made to promote responsible mining practices, environmental protection, and the well-being of local communities. This includes initiatives such as community development projects and adherence to international environmental standards.

India's engagement with the Lithium Triangle nations has gained significant traction in recent years. As India strives to meet its increasing energy demands and transition towards a cleaner and more sustainable energy system, securing a stable supply of lithium has become a strategic priority.

Macroeconomic Overview of Argentina

Argentina is the third largest economy in the Latin American and Caribbean (LAC) Region with a Gross Domestic Product (GDP) of approximately US$ 630.7 billion[1] in 2022. The country possesses abundant agricultural and energy resources with enormous potential for further development. The country has the second-largest shale gas and fourth-largest shale oil reserves in the world, as well as abundant solar and wind energy resources. Argentina features the third-largest proven lithium reserves, after Chile and Australia, and is expected to become a leading exporter over the next decade. More than 70% of Argentina's proven lithium resources are yet to be made commercially viable.

With a well-diversified economy, Argentina's tertiary sector is dominant, exhibiting high productivity and employing advanced technologies. The country boasts a well-developed industrial base and a highly skilled workforce. Notably, the leading industrial sectors include food processing, beverages, chemicals, pharmaceuticals, motor vehicles and auto parts, among others.

Argentina underwent a notable economic expansion from the 1860s until the onset of the Great Depression. This growth was primarily driven by the export of agricultural goods. During the period from 1870 to 1939, country's exports remained heavily concentrated in primary products, as it had limited industrialization due to the absence of energy sources like coal and hydropower. However, there was some diversification of primary exports.

Argentina struggled to sustain economic growth, which coincided with a phase of policy experimentation. Initially, protectionist measures such as import substitution and trade barriers were implemented, along with nationalization efforts. However, there was a shift in policies during the 1960s and 1970s under new leadership, with an emphasis on promoting competition and attracting foreign investment.

The discovery of substantial reserves of oil and natural gas allowed Argentina to meet the increasing energy demands of its industries, transforming the country into a net energy surplus nation. Argentina undertook free-market reforms in the 1990s which included liberalization of trade and capital flows as well as financial sector reforms. The Mining Investment Law of 1993, which was sanctioned with a view to attract investments in the sector and exploit Argentina's reserves of gold, silver and copper, led to growth in the number of projects, production and exports. This created an enabling environment for large-scale lithium mining.

Argentina's economy faced a series of challenges in the past decade. Despite some reforms implemented by the administration in 2015, such as reducing export taxes, lifting currency controls, and resolving debt restructuring issues, fiscal measures to improve budget deficits and reduce inflation were not adequately taken. Additionally, opening the capital account without addressing persistent imbalances resulted in a rapid increase in external debt. The government's financing costs rose as it shifted from debt monetization to relying on international capital markets. The situation worsened with a less favorable investment climate due to a tightening US Federal Reserve and a severe drought in 2018, impacting agricultural export revenue.

These factors culminated in a currency crisis in 2018 which led to the peso losing half of its value against the dollar. The IMF responded by extending a record US$ 57 billion to Argentina, but the deal failed to stabilize the economy. Argentina printed money during the pandemic to finance cash handouts and salary programs, which set the stage for inflation to surge higher. The measures adopted by administration proved ineffective

[1] IMF WEO Database, October 2022

at cooling inflation and currency losses but made the business environment more complex for companies across the country.

The onset of the COVID-19 pandemic further worsened the economic situation, as Argentina entered it with a contracting economy, high debt burden, and limited access to capital.

Despite these challenges, Argentina swiftly responded to the pandemic, focusing on public health measures and implementing economic relief packages to protect vulnerable groups and support businesses. However, the expansionary policies adopted to address the crisis resulted in higher fiscal deficits and public debt, exacerbating inflation and currency devaluation. The real GDP contracted by 9.9% in 2020, and although there was a significant recovery with 10.4% GDP growth in 2021 followed by 4% GDP growth in 2022, inflation remained high at around 48.4% and 72.4% respectively **(Table 1.1)**.

Argentina is on the brink of another recession this year as a historic drought comes on top of inflation. The drought is destroying Argentina's key commodity exports — soy, corn and wheat — that are essential to growth, jobs and tax revenue. The prospect of an economic slowdown also complicates Argentina's latest IMF deal, by making it harder to meet the key targets.

Table 1.1: Macroeconomic Snapshot of Argentina - Select Indicators

Economic Indicators	2018	2019	2020	2021	2022[e]	2023[f]	2024[f]
Real GDP Growth (%)	-2.6	-2.0	-9.9	10.4	4.0	2.0	2.0
GDP (US$ billion)	524.4	451.8	389.1	486.7	630.7	643.8	642.7
GDP per capita, constant prices (PPP, 2017 US$)	22,747.2	22,071.8	19,680.3	21,511.6	22,158.4	22,383.1	22,609.0
Consumer Price Inflation (Avg., %)	34.3	53.5	42.0	48.4	72.4	76.1	51.2
Population (million)	44.5	44.9	45.4	45.8	46.3	46.8	47.2
Merchandise Exports fob (US$ billion)	61.8	65.2	54.8	54.9	78.0	66.9	71.8
Merchandise Imports fob (US$ billion)	62.5	46.9	40.3	40.3	59.3	66.9	67.4
Current account balance (US$ billion)	-27.1	-3.5	3.1	6.7	-2.0	3.7	2.4
Current account balance (% of GDP)	-5.2	-0.8	0.8	1.4	-0.3	0.6	0.4
Total International Reserves (US$ billion)	66.2	44.9	39.4	39.7	44.8	39.1	43.7
Exchange Rate(Avg., Ps:US$)	28.1	48.2	70.5	95.0	130.6	268.1	521.9

Note: [e-] Estimates, [f-] Projections

Source: WEO, IMF, October 2022 and EIU

Macroeconomic Overview of Bolivia

Bolivia is a landlocked country located at the center of South America, sharing borders with Brazil, Paraguay, Argentina, Chile and Peru. Bolivian economy is the 14th largest in Latin America, with a GDP of around US$ 43.4 billion. It is heavily dependent on exports of commodities such as natural gas and minerals.

Mining is a vital part of Bolivia's economy. Due to its endowments, Bolivia is self-sufficient in energy and its natural gas forms a large part of its export revenue. Till 1980s, Bolivia used to be a major producer and exporter of tin, however the collapse of the global tin markets in 1985 led to restructuring of the

mining industry in the country and the consequent growth of the natural gas segment. Natural resource rents account for almost 10% of Bolivia's GDP[2]. The manufacturing sector in Bolivia is dominated by the food and beverages industry and mineral processing as well as oil refining. Textiles are also an important component of the manufacturing sector.

Starting in 1986, the government initiated an economic restructuring process aimed at stabilizing the economy and diminishing the state's involvement. This period of liberalization attracted substantial foreign investments in sectors like oil, natural gas, and technology. Foreign direct investment (FDI) as a percentage of GDP experienced a remarkable surge, rising from 0.3% in 1986 to 12.2% in 1999[3]. Over the period from 1986 to 1998, the GDP grew consistently at a compounded rate of over 6%.

A series of external shocks led to a financial crisis between 1998 and 2002, causing a contraction in Bolivia's output, exports, and an increase in unemployment. Following the crisis, Bolivia shifted its economic policy towards the nationalization of strategic sectors, particularly oil and natural gas. Moving ahead, the country enjoyed substantial economic growth, this resulted in notable reductions in unemployment and poverty levels.

In response to the COVID-19 pandemic, the Bolivian government implemented various measures to mitigate the impact on vulnerable segments of the population. These measures included expanding transfer schemes like Bono Familia and Canasta Familiar, providing financial support to low-income households through the Bono Contra el Hambre program, subsidizing electricity bills, reducing water and gas rates, and deferring certain taxes. To support increased fiscal spending, the authorities secured loans from international organizations including the IMF, the Andean Development Corporation, and the World Bank, amounting to over US$ 600 million. The Bolivian economy contracted by over 8.7% in 2020 **(Table 1.2)**.

Table 1.2: Macroeconomic Snapshot of Bolivia - Select Indicators

Economic Indicators	2018	2019	2020	2021	2022[e]	2023[f]	2024[f]
Real GDP Growth (%)	4.2	2.2	-8.7	6.1	3.8	3.2	3.0
GDP (US$ billion)	40.6	41.2	36.9	40.7	43.4	46.0	49.0
GDP per capita, constant prices (PPP, 2017 US$)	8,688.6	8,757.3	7,882.1	8,242.9	8,441.7	8,589.7	8,732.2
Consumer Price Inflation (Avg., %)	2.3	1.8	0.9	0.7	3.2	3.6	3.5
Population (million)	11.3	11.5	11.6	11.8	12.0	12.1	12.3
Merchandise Exports fob (US$ billion)	8.9	8.8	7.0	11.0	13.2	10.8	11.7
Merchandise Imports fob (US$ billion)	9.3	9.1	6.3	8.7	11.9	11.6	11.9
Current account balance (US$ billion)	-1.7	-1.4	-0.3	0.8	-0.6	-1.0	-1.2
Current account balance (% of GDP)	-4.3	-3.3	-0.7	2.0	-1.4	-2.1	-2.4
Total International Reserves (US$ billion)	8.9	6.5	5.3	4.8	3.8	2.6	2.9
Exchange Rate(Avg., Bs:US$)	6.9	6.9	6.9	6.9	6.9	6.9	8.0

Note: [e-] Estimates, [f-] Projections

Source: WEO, IMF, October 2022 and EIU

[2] World Bank WDI Database

[3] World Bank International Debt Statistics Database.

In 2021, the economy rebounded with a growth rate of 6.1%. Bolivia managed to mitigate inflationary pressures through fuel and food subsidies, as well as some overvaluation of the domestic currency. Given the global trend towards decarbonization and the uncertain prospects of long-term gas contracts, the government is exploring the development of lithium processing as a potential alternative to safeguard revenues in the long run. Economic growth of 3.8% is estimated for 2022. While higher international prices provide support, Bolivia remains a net importer of crude oil and soft commodities.

Macroeconomic Overview of Chile

Chile is a prosperous country in South America known for its strong economy and competitiveness. It has achieved high-income status and is considered a regional leader. In 2022, Chile's GDP reached $310.9 billion, making it the fourth-largest economy in Latin America and the Caribbean. With a GDP per capita of US$ 24,549.6, Chile has the second-highest GDP per capita in South America. The country is also the world's largest producer of copper, contributing to nearly 28.5% of global copper production.

The Great Depression severely impacted Chile's economy, causing a 48% decline in GDP per capita between 1929 and 1932. In response to the Great Depression, Chile adopted import substitution industrialization policies and established the Production Development Corporation in 1939. The government raised tariffs, implemented import quotas and licenses, and created state enterprises to develop basic industries. These policies stimulated various sectors but also led to structural issues in the economy.

In 1973 change of government led to introduction of free-market reforms, including privatization, removal of price controls, deregulation of financial markets, conservative fiscal policies, and trade liberalization through reduced import tariffs. The Latin American debt crisis of 1982 had a significant impact on Chile's economy. Chile implemented measures to address the overvalued exchange rate, carried out recapitalization programs, and reduced external debt. Although bank regulation and capital controls were introduced, the direction of trade liberalization remained unchanged.

Democracy was restored in Chile in 1990, the government put a higher emphasis on social welfare programs to tackle the problem of poverty but continued to practice fiscal prudence by relying primarily upon tax reforms aimed at increasing tax revenues rather than debt which reduced consistently from 36% of GDP in 1991 to less than 12% in 1998. The Asian Financial Crisis impacted Chile's GDP growth, which contracted in 1999 by 0.3%, however, Chile returned to positive growth from 2000. The economy again contracted 1.1% in 2009 as a result of the financial crisis but recovered in the next fiscal. Between 2010-2019, the economy grew at a compounded rate of 2.6% annually, marginally slower than the global growth rate of 2.7%, however much higher than the 1.6% rate in the Latin American and Caribbean region.

The pandemic resulted in a 6.1% contraction of GDP in the year 2020 and unemployment increased. As in other countries, Chile is experiencing economic shocks. In addition to the lingering effects of the COVID-19 pandemic, energy and overall price increases resulting from Russia's conflict with Ukraine have exacerbated inflation. After soaring consumer prices raised inflation rates by nearly 11.6% in 2022 and the Chilean peso hit a sharp devaluation in June 2022, the Central Bank raised interest rates to 9.8% in July 2022 a historic high. With the gradual withdrawal of COVID relief packages and tightening fiscal conditions as well as a decline in real wages caused by rising inflation and the monetary tightening being carried out, growth is expected to slow down in 2022, to an expected 2% **(Table 1.3)**.

Table 1.3: Macroeconomic Snapshot of Chile - Select Indicators

Economic Indicators	2018	2019	2020	2021	2022[e]	2023[f]	2024[f]
Real GDP Growth (%)	3.9	0.9	-6.1	11.7	2.0	-1.0	2.0
GDP (US$ billion)	295.1	278.3	252.3	316.8	310.9	347.6	358.8
GDP per capita, constant prices (PPP, 2017 US$)	24,154.7	23,908.4	22,052.5	24,311.6	24,549.6	24,085.6	24,337.0
Consumer Price Inflation (Avg., %)	2.3	2.3	3.0	4.5	11.6	8.7	4.1
Population (million)	18.8	19.1	19.5	19.7	19.9	20.1	20.3
Merchandise Exports fob (US$ billion)	74.8	68.8	74.0	94.8	98.5	105.1	107.6
Merchandise Imports fob (US$ billion)	70.4	65.8	55.1	84.3	94.7	88.8	90.0
Current account balance (US$ billion)	-13.3	-14.4	-4.3	-21.2	-20.8	-15.4	-12.9
Current account balance (% of GDP)	-4.5	-5.2	-1.7	-6.7	-6.7	-4.4	-3.6
Total International Reserves (US$ billion)	39.9	40.7	39.2	51.3	39.2	43.6	45.6
Exchange Rate(Avg., Ps:US$)	641.2	703.3	792.2	759.1	873.2	808.5	784.0

Note: [e-] Estimates, [f-] Projections

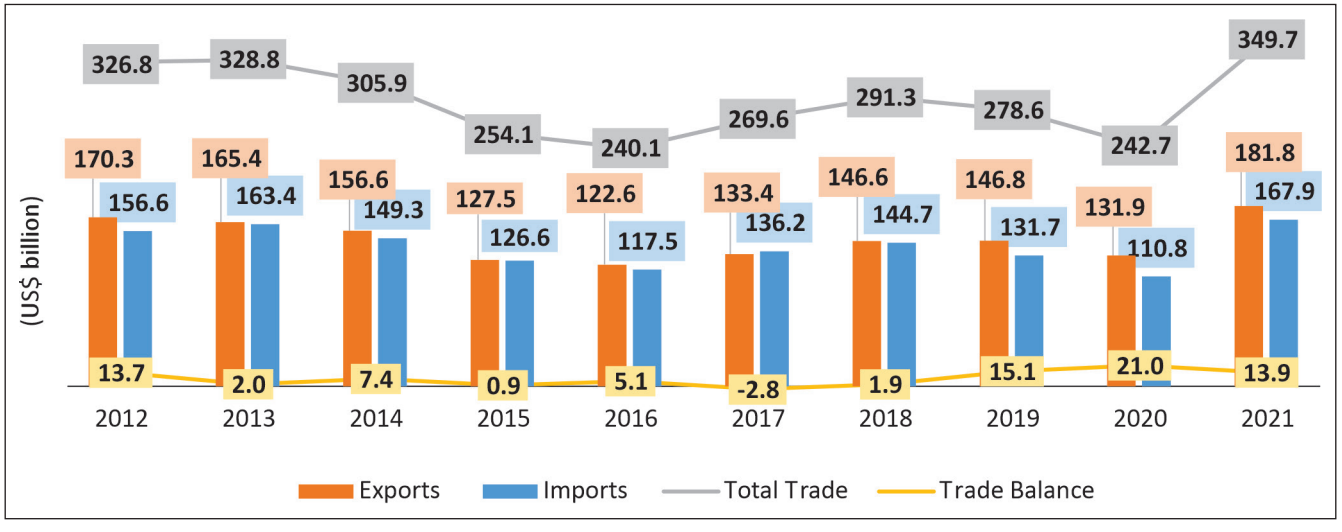
Source: WEO, IMF, October 2022 and EIU

Chapter

2 International Trade Scenario of Lithium Triangle Countries

The merchandise trade of the Lithium Triangle countries with the rest of the world trade witnessed a tremendous year-on-year growth of 44.1% and amounted to US$ 349.7 billion in 2021 **(Chart 2.1)**. Exports amounted to US$ 181.8 billion, while imports stood at US$ 167.9 billion, resulting in a trade surplus of US$ 13.9 billion for the region in 2021. The Lithium Triangle countries have traditionally been a trade surplus region with a deficit witnessed only during 2017 amounting to US$ 2.8 billion, in the last decade.

Chart 2.1: International Merchandise Trade of the Lithium Triangle Countries



Source: ITC Trade Map and India Exim Bank Research

The primary export products for the region include metal ores and concentrates, with a focus on copper, iron, zinc, and precious metals like silver. Chile holds the top position in copper production and amounts for almost 99% of the copper exports of the Lithium Triangle. Subsequently, Bolivia plays a significant role in the global zinc, silver, lead, tin, and tungsten markets. In addition, the Lithium Triangle countries are major suppliers of agricultural products such as corn and wheat. Argentina dominates the region's supply of soybean oil, sunflower seed oil, oilcake, and other solid residues.

The import basket of the Lithium Triangle countries comprises common products including machinery and mechanical appliances, electrical machinery and equipment and transport vehicles including passenger motor vehicles, tractors, and commercial vehicles, among others.

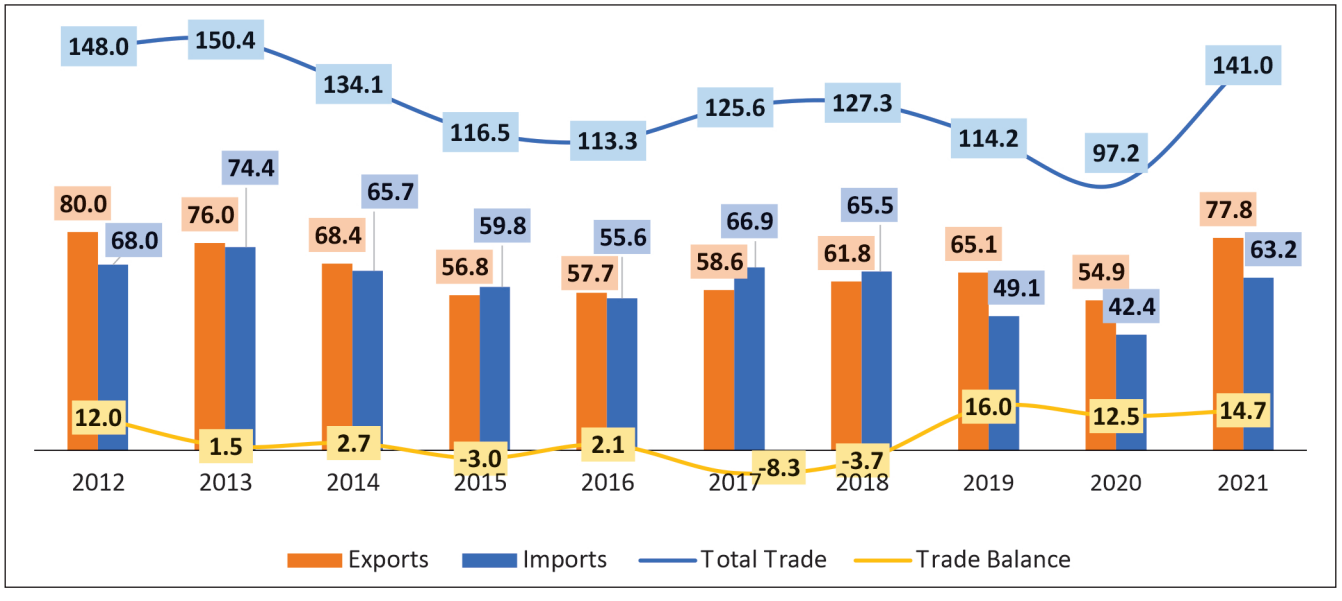
Chile and Bolivia maintain important trade relations with Argentina. Bolivia supplies natural gas to Argentina, while Chile serves as a significant market for Argentinian wheat and corn. Although there is no formal tripartite agreement among the three countries to deepen trade and investment relations with each other, each country individually participates in various regional and international trade blocs and agreements.

Merchandise Trade of Argentina

Argentina's total international merchandise trade stood at over US$ 141 billion in 2021. The total merchandise trade which amounted to US$ 150.4 billion in 2013, witnessed a downward trajectory amounting to US$ 113.3 billion in 2016 resulting from external factors including the recession in Brazil as well as the consequences of foreign-exchange liquidity crisis.

After a brief recovery in 2017 and 2018, the total trade recorded a setback from continuation of the exchange rate and financial tensions of 2018 — entailing a sharp depreciation of the peso, high interest rates and a drop in real family incomes — and the contractionary fiscal policy implemented under the financing agreement with the International Monetary Fund (IMF). Consequently total trade decreased to US$ 114.2 billion in 2019. The COVID-19 pandemic intensified the already ongoing exchange rate crisis and the total trade decreased to US$ 97.2 billion in 2020 before recovering to US$ 141 billion in 2021.

Chart 2.2: Merchandise Trade of Argentina (US$ billion, 2012-2021)



Source: ITC Trade Map and India Exim Bank Research

The agricultural sector plays a crucial role in Argentina's exports. Cereals (HS-10), residues from food industry (HS-23), animal or vegetable fats and oils (HS-15), oil seeds (HS-12) and meat (HS-02), among others, have formed a consistently dominant portion of the country's exports, they together accounted for almost 50% of Argentina's aggregate exports **(Table 2.1)**.

Argentina has been able to diversify its exports well from primary products to manufactured goods. Vehicles other than railway or tramway (HS-87), mineral fuels and oil (HS-27), miscellaneous chemical products (HS-38), natural or cultured pearls and precious or semi-precious stones (HS-71), among others form a significant part of Argentina's merchandise export.

Table 2.1: Argentina's Major Merchandise Exports (US$ billion)

HS Code	Product	2019	2020	2021	Share in 2021 (%)
	All Products	**65.1**	**54.9**	**77.8**	**100.0**
10	Cereals	9.3	9.0	13.6	17.5
23	Residues and waste from the food industries	9.4	8.4	12.5	16.1
15	Animal or vegetable fats and oils	4.4	4.7	8.6	11.1
87	Vehicles other than railway or tramway	6.4	3.8	6.4	8.2
27	Mineral fuels, mineral oils	3.0	2.2	4.2	5.4
12	Oil seeds and oleaginous fruits	4.1	3.4	3.9	5.0
02	Meat and edible meat offal	3.8	3.3	3.4	4.4
38	Miscellaneous chemical products	1.5	1.1	2.5	3.2
71	Natural or cultured pearls, precious or semi-precious stones	2.4	1.9	2.0	2.6
03	Fish and crustaceans	1.8	1.7	2.0	2.6
04	Dairy produce; birds' eggs; natural honey; and edible products of animal origin	0.9	1.1	1.4	1.8
84	Machinery and mechanical appliances	1.1	0.9	1.2	1.5
39	Plastics and articles thereof	0.8	0.7	1.0	1.3
22	Beverages, spirits and vinegar	0.9	0.9	1.0	1.3
30	Pharmaceutical products	0.7	0.7	0.9	1.2

Source: ITC Trade Map and India Exim Bank Research

Argentina's major imports are concentrated in the capital and durable goods segment of manufactured goods. Machinery and mechanical appliances is the largest imported item with a share of 15%, followed by electrical machinery and equipment (10.5%), vehicles other than railway or tramway (10.2%), and mineral fuels and oil (9.2%), among others **(Table 2.2)**.

Table 2.2: Argentina's Major Import Items (US$ billion)

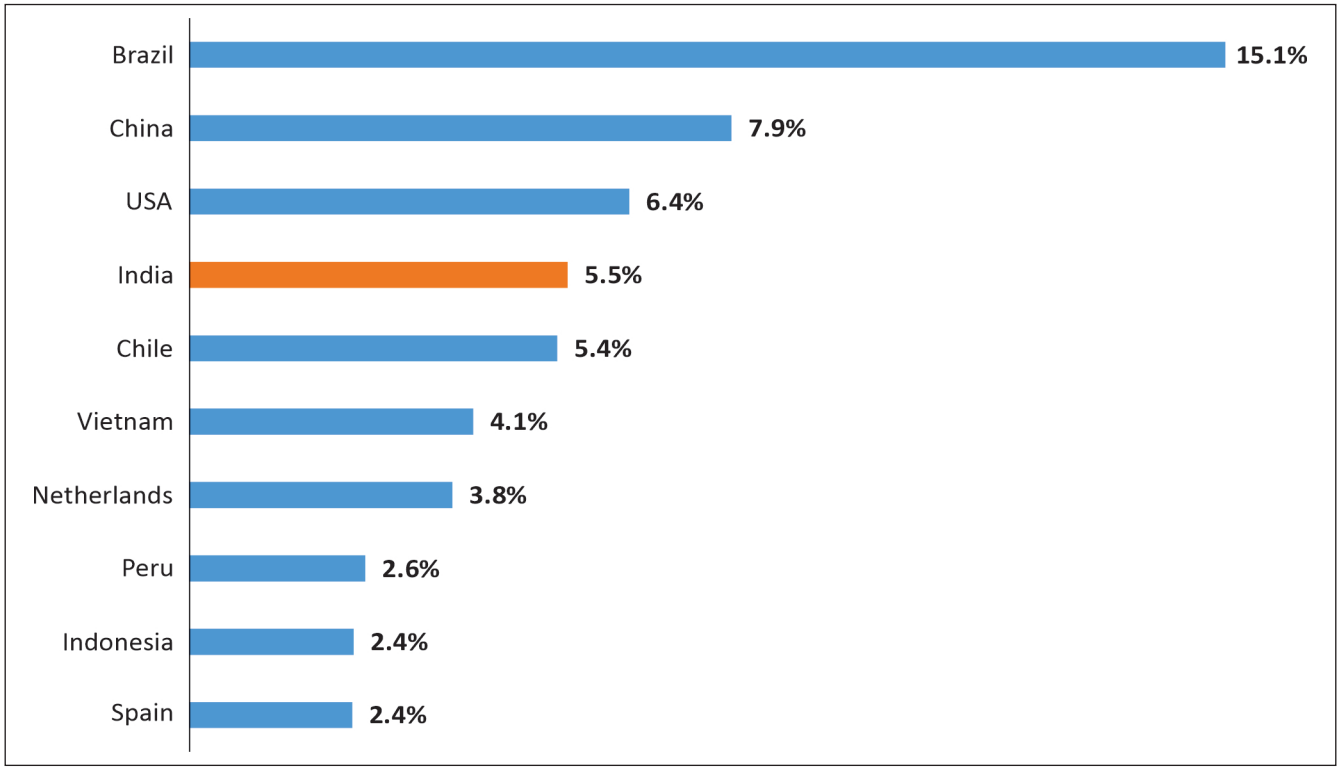
HS Code	Product	2019	2020	2021	Share in 2021 (%)
	All Products	**49.1**	**42.4**	**63.2**	**100.0**
84	Machinery and mechanical appliances	7.6	6.4	9.5	15.0
87	Electrical machinery and equipment	6.4	4.8	6.6	10.5
85	Vehicles other than railway or tramway	5.6	4.6	6.4	10.2
27	Mineral fuels, mineral oils	4.2	2.6	5.8	9.2
29	Organic chemicals	2.4	2.5	3.3	5.3
30	Pharmaceutical products	2.1	2.1	3.3	5.2
39	Plastics and articles thereof	2.1	2.1	3.0	4.8
12	Oil seeds and oleaginous fruits	1.7	2.1	2.7	4.3
31	Fertilisers	1.1	1.1	2.3	3.6

HS Code	Product	2019	2020	2021	Share in 2021 (%)
72	Iron and steel	0.7	0.7	1.8	2.9
90	Optical, photographic, cinematographic, and medical equipment	1.4	1.2	1.6	2.6
38	Miscellaneous chemical products	1.3	1.3	1.4	2.2
40	Rubber and articles thereof	0.9	0.7	1.2	1.8
26	Ores, slag and ash	0.5	0.4	1.1	1.7
73	Articles of iron or steel	0.9	0.6	0.9	1.4

Source: ITC Trade Map and India Exim Bank Research

Brazil was the most important export destination for Argentina's merchandise exports in 2021, accounting for 15.1% of total imports **(Chart 2.3)**. China is the other major export destination with a share of 7.9% in 2021, followed by USA (6.4%), India (5.5%) and Chile (5.4%), among others.

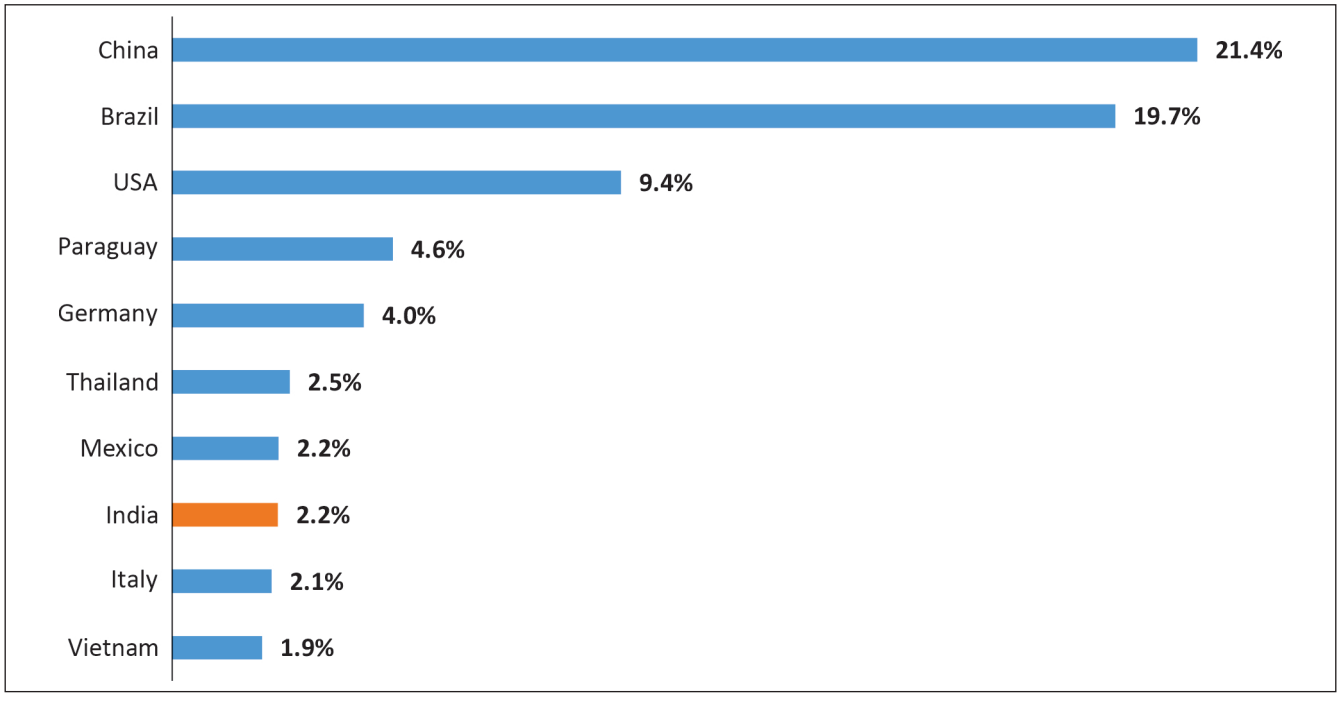
Chart 2.3: Argentina's Top Export Destinations (% Share, 2021)



Source: ITC Trade Map and India Exim Bank Research

In 2021, China overtook Brazil as Argentina's largest source of imports, with a share of 21.4% in Argentina's total imports **(Chart 2.4)**. Brazil ranked as the second largest supplier of imports for Argentina, with a share of 19.7% in total imports, followed by USA (9.4%), Paraguay (4.6%) and Germany (4%), among others. India accounted for 2.2% of Argentina's imports amounting to US$ 1.4 billion.

Chart 2.4: Argentina's Top Import Sources (% Share, 2021)



Source: ITC Trade Map and India Exim Bank Research

Major Trade Agreements of Argentina

Argentina is part of the Southern Common Market (MERCOSUR), which established a customs union between Argentina, Brazil, Paraguay and Uruguay. Bolivia, Chile, Colombia, Ecuador, Guyana, Peru, and Suriname are associate members of the block. As part of MERCOSUR, Argentina has preferential trade agreements with the Southern African Customs Union (SACU), the European Union (EU) and the European Free Trade Association (EFTA). As a member of MERCOSUR Argentina also has trade agreements with Israel, Egypt and India. In July 2022, MERCOSUR and Singapore concluded negotiations of an FTA which is now pending for ratification.

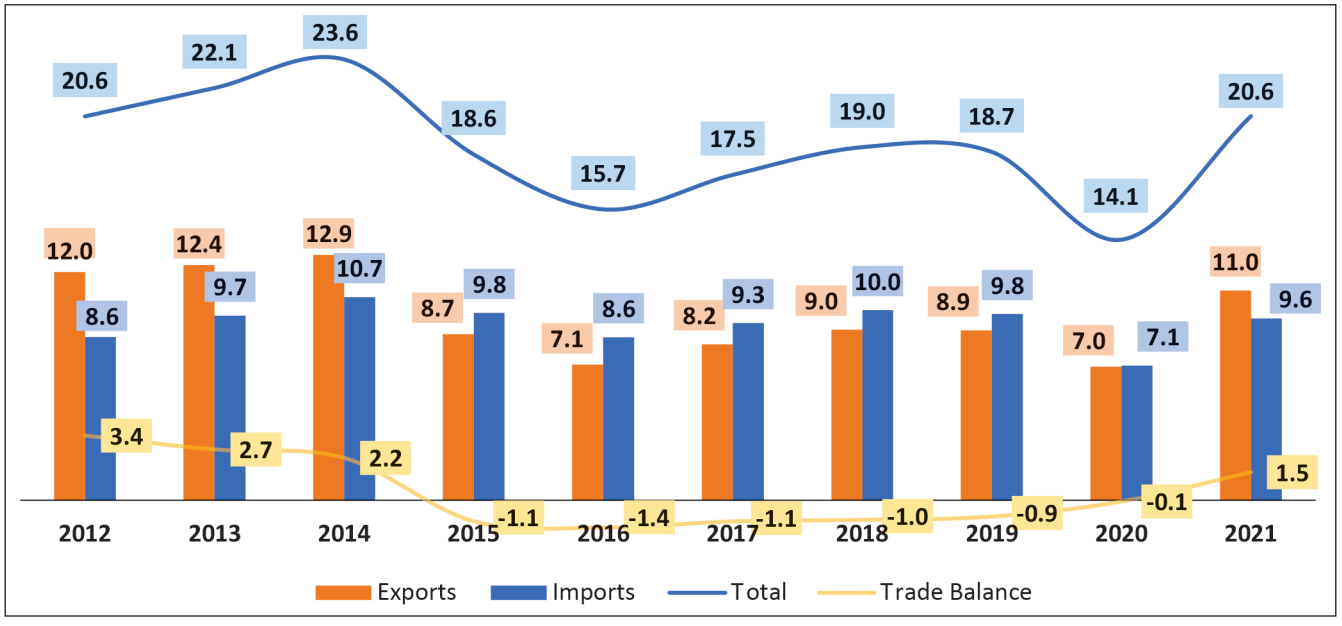
Bolivia's Merchandise Trade

Bolivia recorded a total merchandise trade of US$ 20.6 billion in 2021. Although not large in absolute terms, merchandise trade represents almost 51% of Bolivia's total GDP, implying its significance in Bolivia's rapidly growing economy[4].

In 2021, Bolivia exported goods worth over US$ 11 billion, and its imports totaled US$ 9.6 billion, resulting in a trade surplus of US$ 1.5 billion. On the back of favorable commodity prices and global macroeconomic conditions, Bolivia enjoyed significant trade surpluses from 2004-2014. This was a period of rapid economic growth for the Bolivian economy.

[4] World Bank, World Development Indicators Database

Chart 2.5: Merchandise Trade of Bolivia (US$ billion, 2012-2021)



Source: ITC Trade Map and India Exim Bank Research

Bolivia experienced a large growth spurt wherein merchandise trade increased from US$ 20.6 billion in 2012 to US$ 23.6 billion in 2014. From 2015 onwards, Bolivia faced a consistent trade deficit due to alteration in commodity market conditions, primarily the suppressed prices of hydrocarbons. The COVID-19 pandemic resulted in a major drop in global merchandise trade. Exports declined 21.4% while imports fell by almost 28% as domestic demand took large hit. However, 2021 witnessed a turnaround. Exports expanded by 57.1% and reached their highest level since 2014. Imports also grew significantly by around 35.2%, however they still remain below their pre-pandemic levels.

Bolivia's export basket majorly comprises of natural or cultured pearls and stones (HS-71), ores, slag and ash (HS-26) and mineral fuels and oils (HS-27), together they account for over 70% of exports in 2021 **(Table 2.3)**. Other major exports of Bolivia are residue and waste from the food industries (HS-23), animal or vegetable fats and oils (HS-15) and tin and its articles (HS-80), among others.

Table 2.3: Bolivia's Major Export Items (US$ billion)

HS Code	Product	2019	2020	2021	Share in 2021 (%)
	All Products	**8.9**	**7.0**	**11.0**	**100.0**
71	Natural or cultured pearls, precious or semi-precious stones, precious metals	2.0	1.5	2.9	26.4
26	Ores, slag and ash	2.0	1.5	2.6	23.6
27	Mineral fuels and oils	2.8	2.0	2.3	20.9
23	Residues and waste from the food industries	0.5	0.5	0.7	6.4
15	Animal or vegetable fats and oils	0.3	0.3	0.7	6.4
80	Tin and articles thereof	0.3	0.2	0.5	4.5
08	Edible fruit and nuts	0.2	0.2	0.2	1.8
12	Oil seeds and oleaginous fruits	0.1	0.1	0.2	1.8

Source: ITC Trade Map and India Exim Bank Research

Besides imports of mineral fuels, which account for 23.3% of its total imports, Bolivia predominantly imports manufactured and industrial products. Machinery and mechanical appliances, transport vehicles, electrical machinery and equipment and iron and steel together account for around 32% of the country's total imports in 2021 **(Table 2.4)**.

Table 2.4: Bolivia's Major Import Items (US$ billion)

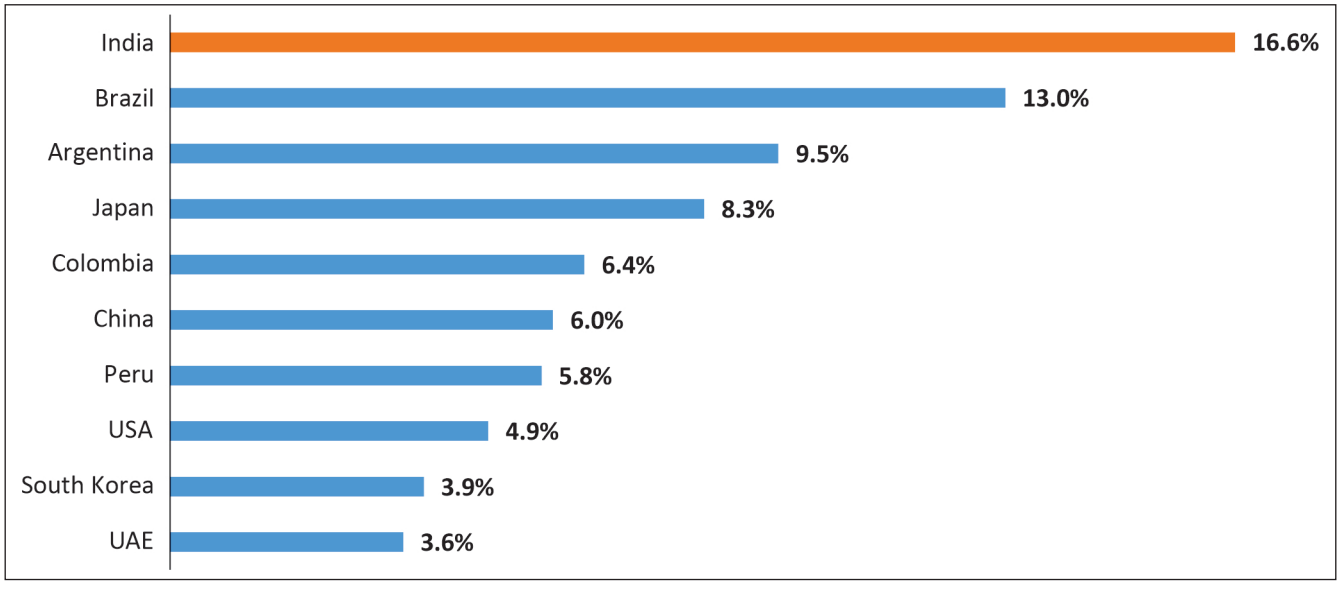
HS Code	Product	2019	2020	2021	Share in 2021 (%)
	All Products	**9.8**	**7.1**	**9.6**	**100.0**
27	Mineral fuels and oils	1.6	0.9	2.2	23.3
84	Machinery and mechanical appliances	1.2	0.8	1.0	10.6
87	Vehicles other than railway or tramway	1.1	0.7	0.9	9.4
85	Electrical machinery and equipment	0.9	0.5	0.6	6.1
72	Iron and steel	0.5	0.3	0.6	6.0
39	Plastics and articles thereof	0.5	0.4	0.5	5.5
38	Miscellaneous chemical products	0.3	0.3	0.4	3.8
30	Pharmaceutical products	0.2	0.2	0.3	2.7
73	Articles of iron or steel	0.3	0.2	0.2	2.5
40	Rubber and articles thereof	0.2	0.1	0.2	1.9
90	Optical, photographic, cinematographic, and medical equipment	0.2	0.2	0.2	1.8
21	Miscellaneous edible preparations	0.2	0.1	0.2	1.8

Source: ITC Trade Map and India Exim Bank Research

India was the top destination for exports of Bolivia with a value of US$ 1.8 billion, accounting for a share of 16.6%. India was followed by Brazil (13% of Bolivia's total exports), Argentina (9.5%), Japan (8.3%) and Colombia (6.4%) **(Chart 2.6)**. Latin American Countries (LACs) account for over 40% of Bolivia's exports. The Asian region makes up another 40% of the country's exports.

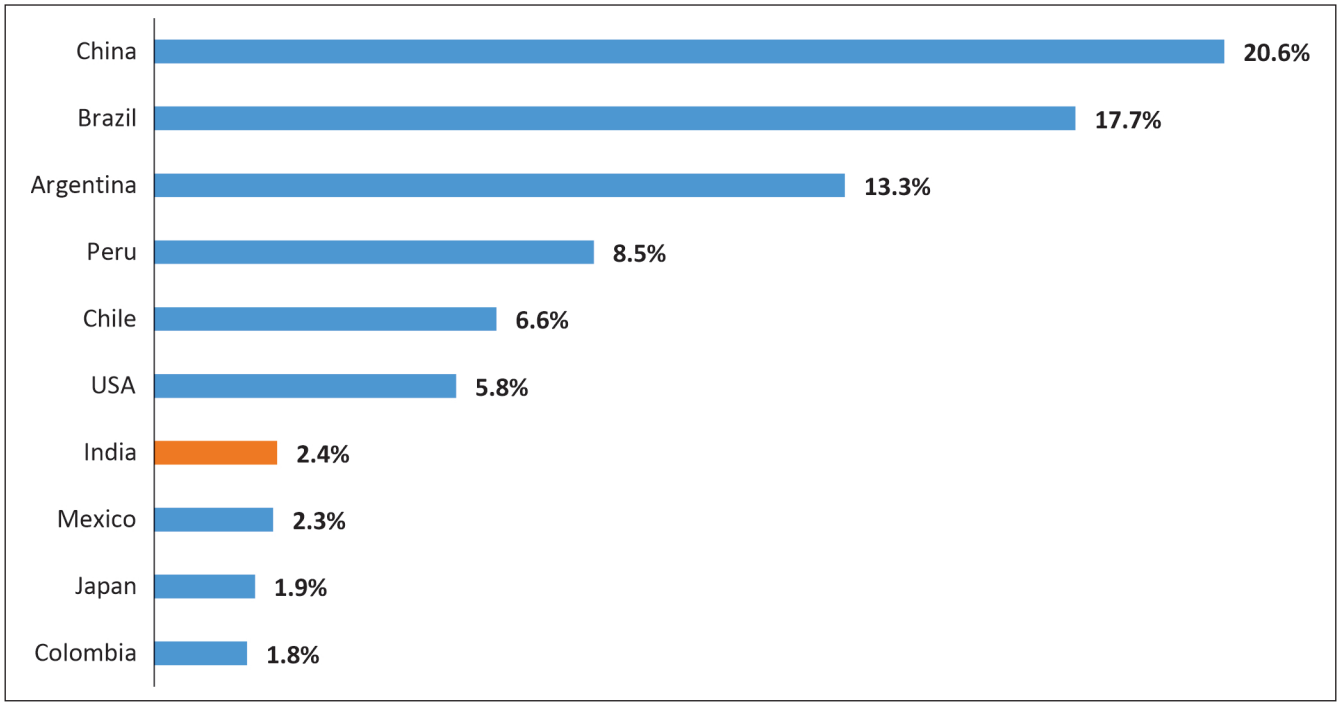
China is the largest supplier of merchandise goods to Bolivia. Bolivia imported goods amounting to US$ 2 billion from China in 2021, representing 20.6% of its total imports **(Chart 2.7)**. Brazil is Bolivia's second largest imports supplier with a share of 17.7% of the total, followed by Argentina (13.3%), Peru (8.5%), Chile (6.6%), USA (5.8%) and India (2.4%), among others.

Chart 2.6: Bolivia's Top Export Destination (% Share, 2021)



Source: ITC Trade Map and India Exim Bank Research

Chart 2.7: Bolivia's Top Import Sources (% Share, 2021)



Source: ITC Trade Map and India Exim Bank Research

Bolivia's Trade Agreements

Bolivia is part of the Andean Community along with Colombia, Ecuador and Peru. The Andean Community is a free trade area (with the objective of creating a customs union), which along with MERCOSUR are the two main trade blocs in South America. Bolivia is also a part of the Latin American Integration Association (LAIA) under which it is classified under the group of countries of lesser relative economic development and hence, receives unilateral preferences such as reduction/elimination of tariffs and other restrictions by other

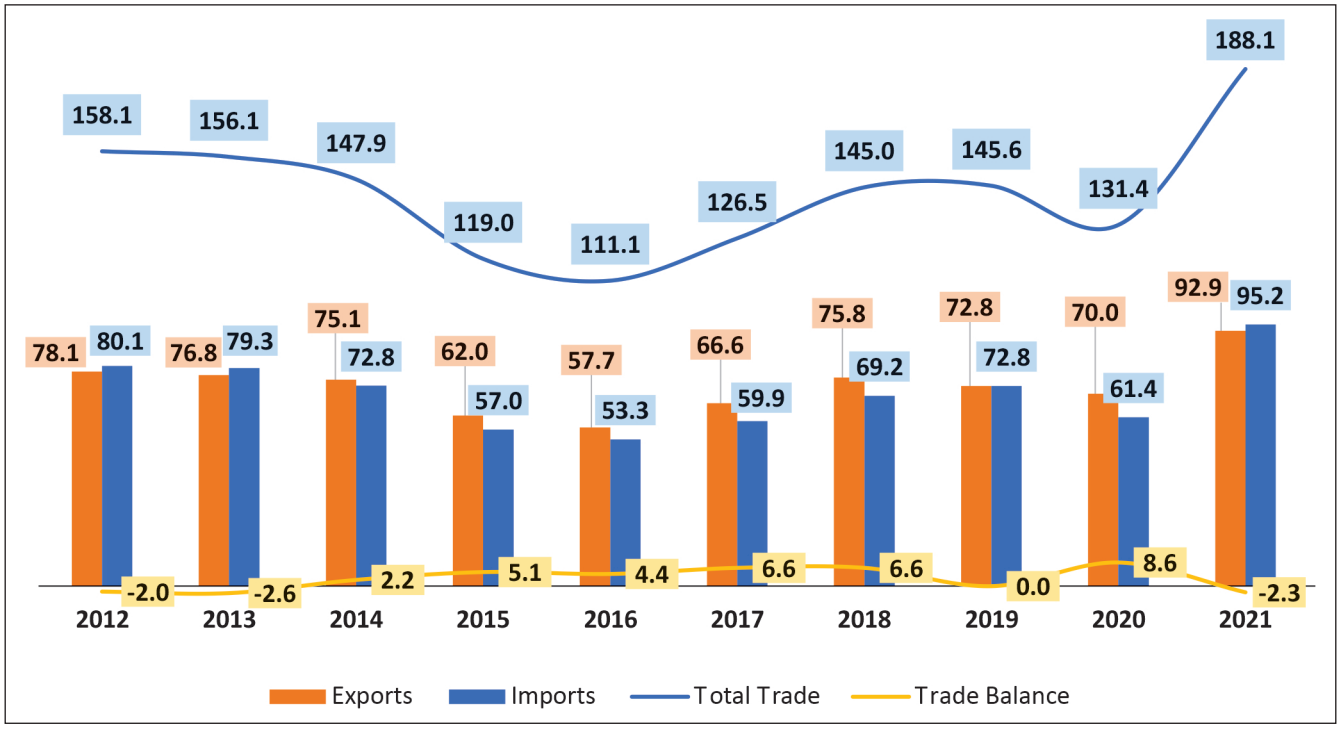
member countries. Within the LAIA, Bolivia has economic complementarity agreements with Cuba, Chile, MERCOSUR and Mexico. Bolivia is also the recipient of benefits of preferential access schemes under the Generalized System of Preferences (GSP) provided by several advanced economies.

Argentina and Brazil are two most important markets for Bolivian natural gas. In the absence of long-term contracts, Bolivia contract renewal negotiations are recurrent and with global energy transition towards renewable sources, these negotiations are bound to become tougher. In addition, Bolivia, being a landlocked country relies heavily on Chile for its ports[5].

Chile's Merchandise Trade

Chile's merchandise trade equaled US$ 188.1 billion in 2021, with exports amounting to US$ 92.9 billion and imports at US$ 95.2 billion, resulting in a trade deficit of about US$ 2.3 billion **(Chart 2.8)**. The merchandise trade to GDP ratio for 2021 stood at 58.9%, implying a longstanding free trade policy stance of Chile.

Chart 2.8: Merchandise Trade of Chile (US$ billion, 2012-2021)



Source: ITC Trade Map and India Exim Bank Research

The period from 2012 to 2016 witnessed fall in both exports and imports stemming from reduced prices and demand for commodities such as copper amid a slowing global economy. Exports fell from US$ 78.1 billion in 2012 to US$ 57.7 billion in 2016 and imports declined from US$ 80.1 billion to US$ 53.3 billion during the same period. Starting from 2016, exports became an even more critical component as Chile's GDP continued to slow down. The pandemic had a relatively mild impact on Chile, with exports falling by less than 4% and on the other hand imports contracting by 15.7%. Chile's economic recovery has been driven by manufacturing and trade; exports expanded by 32.8% while imports increased by 55% year-on-year in 2021.

[5] Economist Intelligence Unit, Country Report, Bolivia, June 2022

Chile's export basket primarily comprises of ores and metals, in line with Chile's geographical structure and endowment of natural resource. The proximity of mines to ports also incentivizes the export of ore concentrates rather than their processing in manufacturing plants located distantly as a result of high inland transportation costs. Chile is the largest producer and supplier of copper in the world. Copper ores and concentrates and article thereof accounted for roughly 54% of Chile's merchandise trade in 2021. Other major exports of Chile include edible fruits and nuts (HS-08), fish and crustaceans (HS-03), pulp of wood or of other fibrous cellulosic material (HS-47) and wood and its articles (HS-44), among others **(Table 2.5)**.

Table 2.5: Chile's Major Export Items (US$ Billion)

HS Code	Product	2019	2020	2021	Share in 2021 (%)
	All Products	**72.78**	**69.96**	**92.89**	**100.0**
26	Ores, slag and ash	20.5	20.7	31.4	33.8
74	Copper and its articles	14.9	15.7	23.2	25.0
08	Edible fruit and nuts	5.8	5.8	6.5	7.0
03	Fish and crustaceans	5.8	4.9	5.8	6.2
47	Pulp of wood or of other fibrous cellulosic material	2.7	2.1	2.7	2.9
44	Wood and articles of wood	2.3	2.2	2.6	2.8
28	Inorganic chemicals	2.1	2.0	2.4	2.6
22	Beverages, spirits and vinegar	2.0	1.8	2.0	2.2
84	Machinery and mechanical appliances	2.1	1.4	1.6	1.7
02	Meat and edible meat offal	1.1	1.4	1.4	1.5
71	Natural or cultured pearls and precious stones	1.4	1.3	1.3	1.4
20	Preparations of vegetables, fruit and nuts	0.6	0.6	0.7	0.8

Source: ITC Trade Map and India Exim Bank Research

Chile is a major importer of energy-based commodities. Fuels including crude and non-crude petroleum oils, petroleum gas as well as coal and its derivative products, among others account for almost 18.5% of the country's imports **(Table 2.6)**. Other major imports include machinery and mechanical (HS-84), electrical machinery and equipment (HS-85), and vehicles other than railway or tramway (HS-87), among others.

Table 2.6: Chile's Major Import Items (US$ billion)

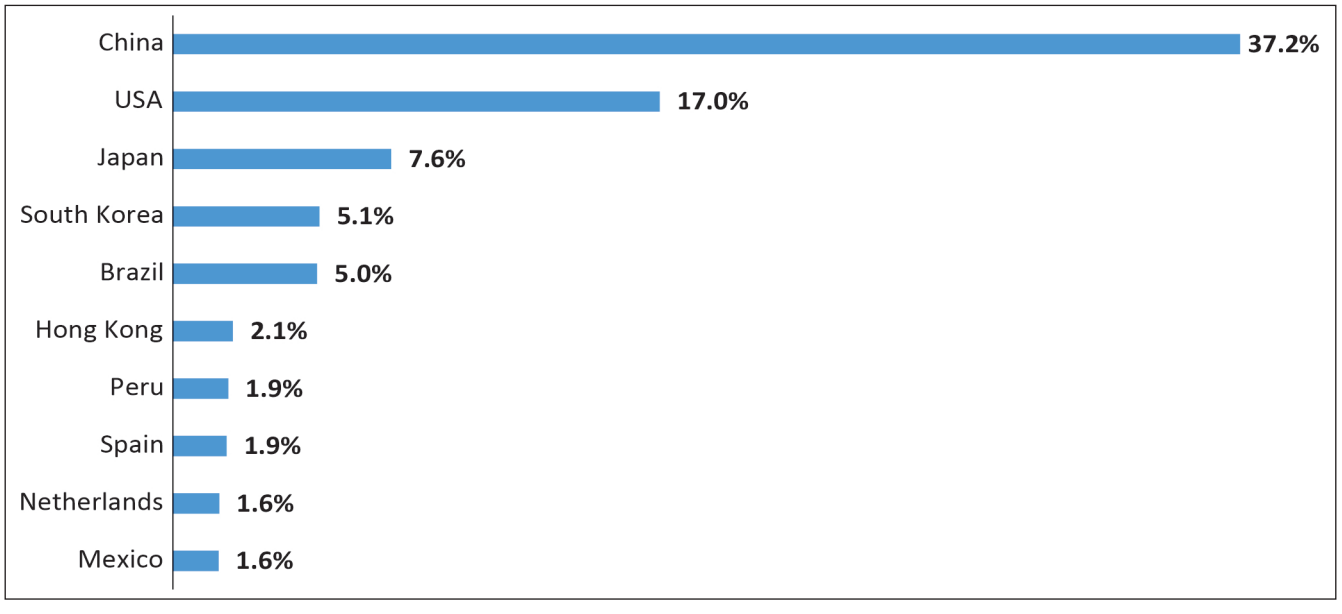
HS Code	Product	2019	2020	2021	Share in 2021 (%)
	All Products	**72.8**	**61.4**	**95.2**	**100.0**
27	Mineral fuels and oils	14.2	9.7	17.6	18.5
84	Machinery and mechanical appliances	8.9	8.1	11.0	11.5
85	Electrical machinery and equipment	6.2	7.3	9.9	10.4
87	Vehicles other than railway or tramway	8.9	5.0	9.7	10.2
39	Plastics and articles thereof	2.3	2.2	3.6	3.8

HS Code	Product	2019	2020	2021	Share in 2021 (%)
30	Pharmaceutical products	1.7	1.8	2.5	2.6
72	Iron and steel	1.6	1.2	2.4	2.6
2	Meat and edible meat offal	1.5	1.5	2.4	2.5
73	Articles of iron or steel	1.5	1.3	1.9	2.0
10	Cereals	1.2	1.4	1.8	1.8
90	Optical, photographic, cinematographic, and medical equipment	1.4	1.4	1.7	1.8
23	Residues and waste from the food industries	1.0	1.0	1.4	1.5
61	Articles of apparel and clothing accessories, knitted or crocheted	1.2	0.9	1.4	1.5
40	Rubber and its articles	1.1	1.0	1.4	1.5
38	Miscellaneous chemical products	0.9	1.0	1.3	1.4

Source: ITC Trade Map and India Exim Bank Research

China is largest market for Chile's exports, accounting for 37.6% of its total exports in 2021 **(Chart 2.9)**. China is followed by the USA (17% share in total exports), Japan (7.6%), South Korea (5.1%), Brazil (5%) and Hong Kong (2.1%), among others.

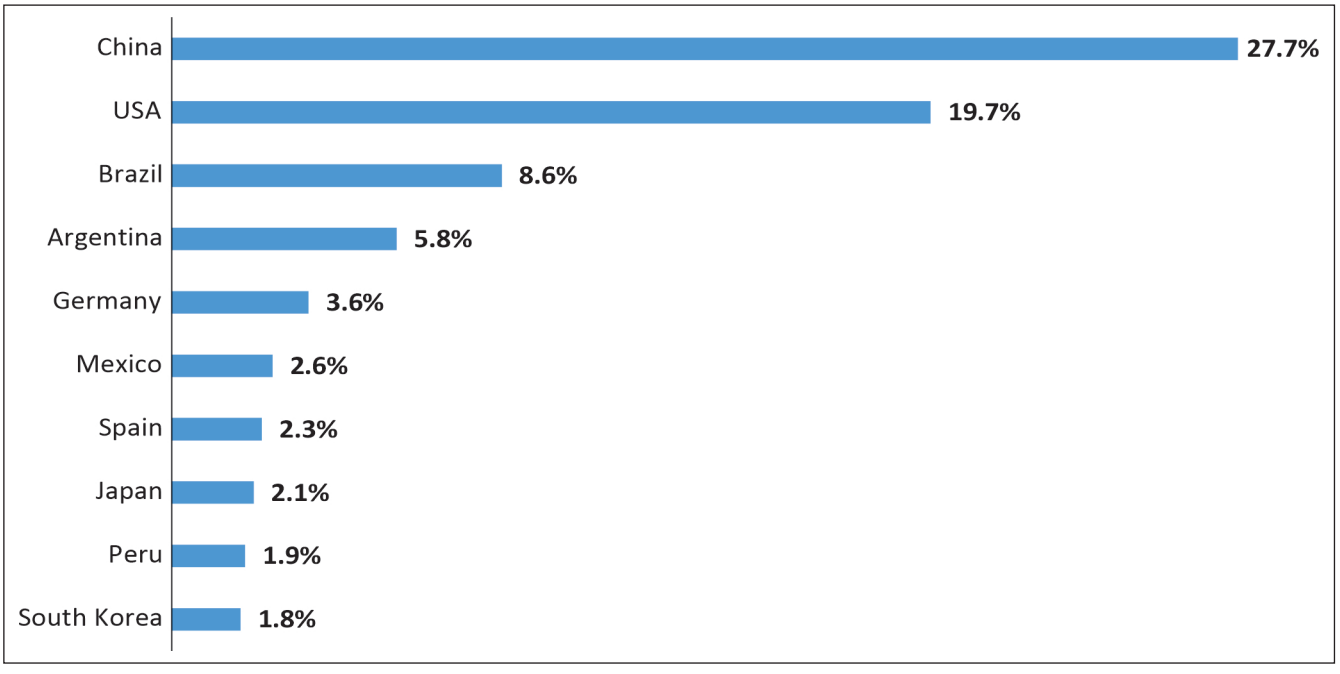
Chart 2.9: Chile's Top Export Destinations (% Share, 2021)



Source: ITC Trade Map and India Exim Bank Research

China also tops the list of Chile's largest imports suppliers. In 2021, Chile imported US$ 26.4 billion worth of merchandise from China, accounting for 27.7% of Chile's imports **(Chart 2.10)**. Other major import sources were the USA (19.7% share in total imports), Brazil (8.6%), Argentina (5.8%) and Germany (3.6%), among others.

Chart 2.10: Chile's Top Import Sources (% Share, 2021)



Source: ITC Trade Map and India Exim Bank Research

Major Trade Agreements of Chile

Chile follows an open trade strategy based on trade agreements. Chile has negotiated 31 trade agreements, covering 65 economies, representing 88% of the world's GDP[6]. These agreements include 17 FTAs, three Economic Association Agreements, six Economic Cooperation Agreements, one Partial Association Agreement with India, and a Commercial Protocol with the Pacific Alliance (Colombia, Perú and Mexico).

The most recent trade agreement is an Economic Association Agreement with the UK that came into effect on January 1, 2021. Chile was a founding member of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CP-TPP), which includes Australia, Brunei, Canada, Japan, Malaysia, Mexico, New Zealand, Perú, Singapore and Vietnam. Approval is pending ratification in the Chilean Congress. Chile's participation in the Digital Economy Partnership Agreement, DEPA, is being discussed in Congress after being introduced in April 2021.

This network of trade agreements has significantly improved market access for Chilean products and exports. According to the Chilean Ministry for International Economic Relations (Subrei), over 95% of Chile's exports in 2021 went to countries with which Chile has free trade agreements, compared to 94% during 2020.

[6] International Trade Administration, USA

Chapter

3

India's Trade Relations with Lithium Triangle Countries: Current Scenario and Potential

There are natural synergies for greater economic cooperation between India and the Lithium Triangle countries in diverse sectors including agriculture and allied activities, food processing, pharmaceutical, textiles & garments, mining and metallurgy, automotive and chemicals. Given the bilateral complementarities exiting between India and the Lithium Triangle countries there also exist mutually rewarding opportunities and potential in areas such as mineral processing, infrastructure development, construction and the hydrocarbons sector.

This chapter endeavors to further identify sectors where potential exists to enhance bilateral commercial relations with countries in the region based on India's export potential and demand existing in the Lithium Triangle.

Identification of Potential Commodities

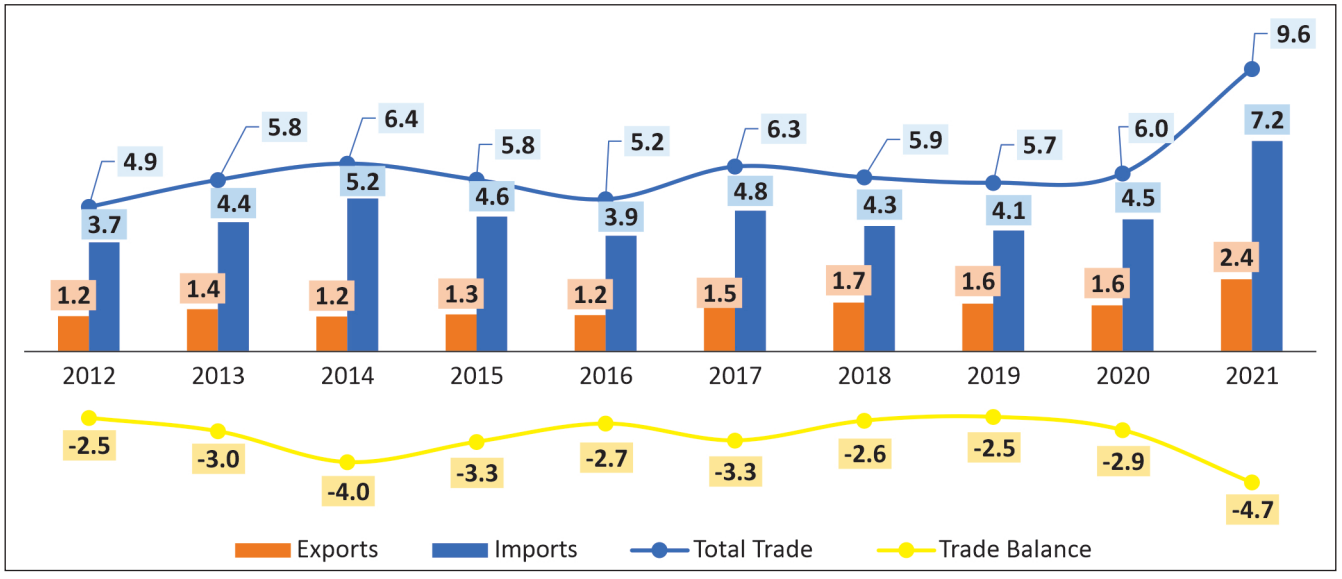
Certain criteria were considered to identify the commodities with potential for exports from India to the Lithium Triangle countries, which include:

- Identifying the major products in partner countries' import basket (products with ≥1% share in total imports) and determining India's share in each product category, at 2-digit HS Code level.
- Identifying those products for which India's share in partner countries' imports of the particular product is lower than India's share in partner countries' total imports.
- Finally, analysis of the import basket composition of the partner country and matching with India's export capability (based on 2-digit HS code). The criteria to classify an item as a major export item is that the product should have a share of 1% or higher in India's total exports.

India's Merchandise Trade Relations with the Lithium Triangle

India's trade with the Lithium Triangle region has witnessed rapid growth in the past decade. Total trade almost doubled in 2021 to US$ 9.6 billion from US$ 4.9 billion in 2012 **(Chart 3.1)**. India's exports to Lithium Triangle countries were close to US$ 2.5 billion in 2021, up by over 56% over 2020 while imports stood at US$ 7.2 billion, an increase of over 59% over previous year.

Chart 3.1: India's Trade with Lithium Triangle (US$ billion)



Source: ITC Trade Map and India Exim Bank Research

India has emerged as a key supplier of imports and market for Lithium Triangle's exports during the last decade. India's share in Lithium Triangle's exports has more than doubled from 1.7% in 2011 to 3.9% in 2021. At the same time, the share of India's exports in Lithium Triangles' total imports has also improved from just 0.6% in 2011 to 1.5% in 2021.

Argentina, Bolivia and Chile together constitute a key part of India's overall trade with the Latin America and Caribbean (LAC) region. The triad accounts for 13% of India's total exports to the region and 29.5% of the region's total exports to India in 2021, indicative of flourishing economic relations between India and the Lithium Triangle region.

India's export basket to the Lithium Triangle is well diversified. It's top exports to Lithium Triangle consist of the following items:

- Transport vehicles (HS-87)
- Mineral fuels and oils and products of their distillation (HS-27)
- Pharmaceutical products (HS-30)
- Organic chemical (HS- 29)
- Miscellaneous chemical products (HS-38)
- Iron and steel (HS-72), among others.

In addition, India also accounts for a large share in Lithium Triangle's imports of man-made staple fibers (13.4%), man-made filaments (12.8%), and cotton (25%).

India's import basket from the Lithium Triangle majorly contains primary and agriculture-based products. The Lithium Triangle is a key supplier of a selected range of items for India including:

- Animal or vegetable fats and oils (HS-15)
- Natural or cultured pearls, precious or semi-precious stones, precious metals etc. (HS-71)

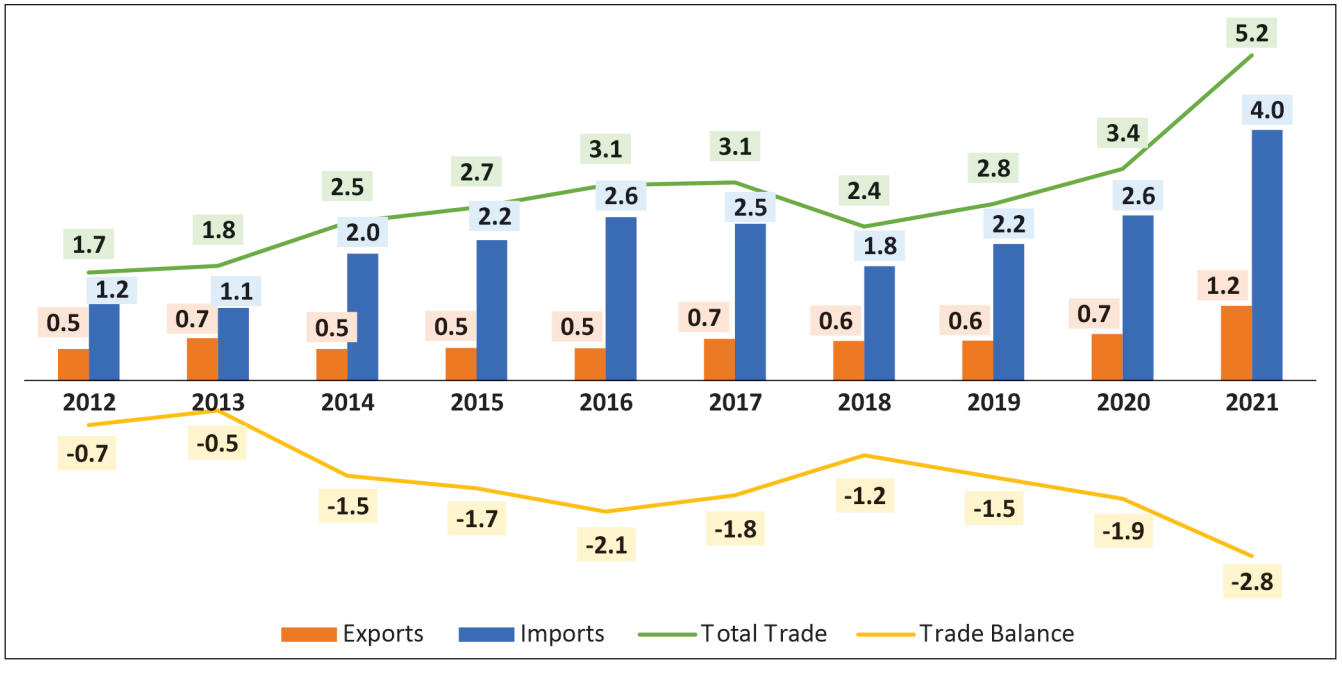
- Ores, Slag and Ash (HS-26)
- Residues and waste from the food industries and animal fodder (HS-23)
- Edible fruits and nuts (HS-08)
- Inorganic chemicals (HS-28), among others.

Enhancing trade with the Lithium Triangle countries holds a strategic importance for India as it seeks to secure reserves of critical minerals like lithium. Moreover, while trade with the three countries that constitute the Lithium Triangle has proliferated, it is characterized by a growing imbalance with India facing mounting trade deficit. It is important for India to recognize opportunities where Indian exports can fulfill the import demands of the Lithium Triangle countries in order to create a more balanced and sustainable two-way exchange of goods.

India-Argentina Bilateral Merchandise Trade Relations

India and Argentina have shared bilateral relations for close to a century since Argentina established a Consulate in Calcutta in the 1920s. The relations were elevated when India opened a Trade Commission in the Argentine capital city of Buenos Aires in 1943 which was later converted into one of India's first Embassies in the South American region in 1949. Argentina's Consulate in Calcutta was converted into an Embassy in 1950, at the time of its transfer to Delhi[7].

Chart 3.2: India's Bilateral Trade with Argentina (US$ billion)



Source: ITC Trade Map and India Exim Bank Research

As part of MERCOSUR, Argentina has a standing Preferential Trade Agreement (PTA) with India which became operational in 2009. The agreement covers 452 products for tariff concession offered by MERCOSUR with major products being food preparations, organic chemicals, pharmaceuticals, plastics and articles, essential oils, machinery, electrical machinery and equipment, essential oils, tools and implements and rubber and its

[7] Ministry of External Affairs, Briefs on Foreign Relations, India-Argentina bilateral Relations, 2017

products. On the other hand, India has offered tariff concessions on 450 products covering meat and meat products, raw hides and skins, articles of leather, wool, cotton yarn, articles of iron and steel, organic and inorganic chemicals, dyes and pigments etc. Talks are underway for the expansion of the current lists to 1500 to 2000 products[8].

Trade between India and Argentina has expanded rapidly in the past decade. From US$ 1.6 billion in 2011, trade has more than tripled to almost US$ 5.2 billion in 2021. Indian exports have increased over 156% from US$ 462.9 million in 2011 to US$ 1.2 billion in 2021. Imports have increased by over 262% from US$ 1.1 billion in 2011 to roughly US$ 4 billion in 2021. The trade ties between the two countries look robust considering that trade expanded even in the year of the pandemic by 19.8%, while total world trade fell almost 7.3% in the same year.

India's Merchandise Exports to Argentina

India's exports to Argentina totaled US$ 1.2 billion in 2021. Mineral fuels and oil are the largest exported commodity with a share of 29.7%, followed by organic chemicals (9.1%), miscellaneous chemical products (10.4%), vehicles other than railway or tramway (10.6%) and iron and steel (8.5%), among others **(Table 3.1)**.

Table 3.1: India's Major Export Items to Argentina (US$ million)

HS Code	Product Label	2019 (US$ million)	2020 (US$ million)	2021 (US$ million)	Share in 2021 (%)
Total	**All products**	**633.9**	**739.1**	**1,187.0**	**100.0**
27	Mineral fuels, mineral oils	111.0	219.8	352.5	29.7
29	Organic chemicals	84.1	97.3	108.6	9.1
38	Miscellaneous chemical products	105.8	92.2	123.6	10.4
87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	29.1	47.0	125.9	10.6
72	Iron and steel	24.1	30.0	100.6	8.5
84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	36.6	27.5	48.3	4.1
54	Man-made filaments; strip and the like of man-made textile materials	28.4	26.6	46.9	4.0
30	Pharmaceutical products	15.7	26.4	25.6	2.2
55	Man-made staple fibres	17.5	24.0	35.9	3.0
32	Tanning or dyeing extracts	25.6	21.7	27.9	2.4
40	Rubber and articles thereof	13.6	15.5	19.0	1.6
39	Plastics and articles thereof	15.1	14.8	39.9	3.4
85	Electrical machinery and equipment	20.6	14.0	11.9	1.0
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical devices	12.7	10.4	13.8	1.2
52	Cotton	4.8	9.2	16.2	1.4

Source: ITC Trade Map and India Exim Bank Research

[8] Embassy of India, Buenos Aires, Argentina : India and Mercosur (indembarg.gov.in)

India's Merchandise Imports from Argentina

India's top import items from Argentina in 2021 comprised primarily animal or vegetable fats and oils, amounting to US$ 3 billion, with a massive share of 76.7% **(Table 3.2)**. Other major Indian imports from Argentina include natural or cultured pearls, precious or semi-precious stones (13.5%) and residues and waste from food industries (5.0%), among others.

Table 3.2: India's Major Import Items from Argentina (US$ million)

HS Code	Product Label	2019	2020	2021	Share in 2021 (%)
Total	**All products**	**2,167.7**	**2,617.6**	**3,975.2**	**100.0**
15	Animal or vegetable fats and oils	1,789.8	2,225.9	3,047.2	76.7
71	Natural or cultured pearls and stones	156.8	258.9	538.2	13.5
23	Residues and waste from the food industries	17.6	5.9	198.8	5.0
27	Mineral fuels and oils	15.9	4.0	34.8	0.9
44	Wood and articles of wood	0.0	0.1	26.9	0.7
29	Organic chemicals	15.6	18.0	24.5	0.6
41	Raw hides and skins	40.8	24.0	19.7	0.5
38	Miscellaneous chemical products	13.5	13.4	16.1	0.4
90	Optical, photographic, cinematographic, and medical equipment	6.2	4.5	10.8	0.3
07	Edible vegetables and certain roots and tubers	8.1	3.6	9.6	0.2
28	Inorganic chemicals	3.6	4.7	9.3	0.2
84	Machinery and mechanical appliances	9.1	6.1	7.9	0.2
35	Albuminoidal substances	0.2	1.4	3.6	0.1
31	Fertilizers	2.9	5.2	3.5	0.1
32	Tanning or dyeing extracts	2.6	2.8	3.5	0.1
87	Vehicles other than railway or tramway	3.1	0.6	2.4	0.1
10	Cereals	34.2	18.2	2.3	0.1

Source: ITC Trade Map and India Exim Bank Research

Opportunities for Enhancing Trade Engagement Between India and Argentina

Argentina accounted for 50% of India's total exports to and 57% of total imports from the region. However, potential exists to further enhance India's exports, based on the import demand in Argentina, and India's export capability. **Table 3.3** presents Argentina's major import items, in terms of 2-digit HS code, and India's share in Argentina's global imports of these items. As may be seen from the table, India has not achieved a healthy share in majority of Argentina's global imports during 2021. India's share in Argentina's global imports of all major items is marginal, which would serve to highlight the potential to further enhance these exports to Argentina, in line with the huge import demand in the country. At the same time some of these items are also amongst India's leading global export items, which highlight India's export capability. Based on the pre-defined criteria, the potential export items from India to Bolivia would thus include:

- HS-84 – Machinery, mechanical appliances, nuclear reactors and boilers
- HS-85 – Electrical machinery and equipment
- HS-30 – Pharmaceutical products
- HS-39 – Plastics and articles thereof
- HS-90 – Optical, photographic, measuring, medical or surgical devices and equipment
- HS-40 – Rubber and articles thereof
- HS-26 – Ores, slag and ash
- HS-73 – Articles of iron and steel

Table 3.3: Argentina's Major Global Imports and India's Share, 2021

HS Code	Product Label	Argentina Total Imports (US$ million)	India's Exports to Argentina (US$ million)	India's Share in Argentina's Total Imports	India's Exports to World (US$ million)	Share in India's Total Exports
Total	**All products**	**63183.8**	**1187.0**	**1.9%**	**394813.7**	**100.0%**
84	Machinery, mechanical appliances, nuclear reactors, boilers and their parts	9537.0	48.3	0.5%	24165.8	6.1%
85	Electrical machinery and equipment	6637.9	11.9	0.2%	18836.2	4.8%
87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	6427.9	125.9	2.0%	18897.2	4.8%
27	Mineral fuels, mineral oils	5802.9	352.5	6.1%	56400.6	14.3%
29	Organic chemicals	3337.0	108.6	3.3%	21184.1	5.4%
30	Pharmaceutical products	3294.4	25.6	0.8%	19460.5	4.9%
39	Plastics and articles thereof	3038.5	39.9	1.3%	8555.2	2.2%
12	Oil seeds and oleaginous fruits	2726.3	0.9	0.0%	1780.5	0.5%
31	Fertilisers	2284.6	0.0	0.0%	85.0	0.0%
72	Iron and steel	1837.1	100.6	5.5%	21199.5	5.4%
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical devices	1614.4	13.8	0.9%	3912.9	1.0%
38	Miscellaneous chemical products	1388.3	123.6	8.9%	6473.7	1.6%
40	Rubber and articles thereof	1155.9	19.0	1.6%	4452.0	1.1%
26	Ores, slag and ash	1075.6	0.1	0.0%	4519.8	1.1%
73	Articles of iron or steel	881.1	7.9	0.9%	8361.2	2.1%
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	750.0	1.0	0.1%	2954.7	0.7%
28	Inorganic chemicals	730.7	9.4	1.3%	2409.7	0.6%

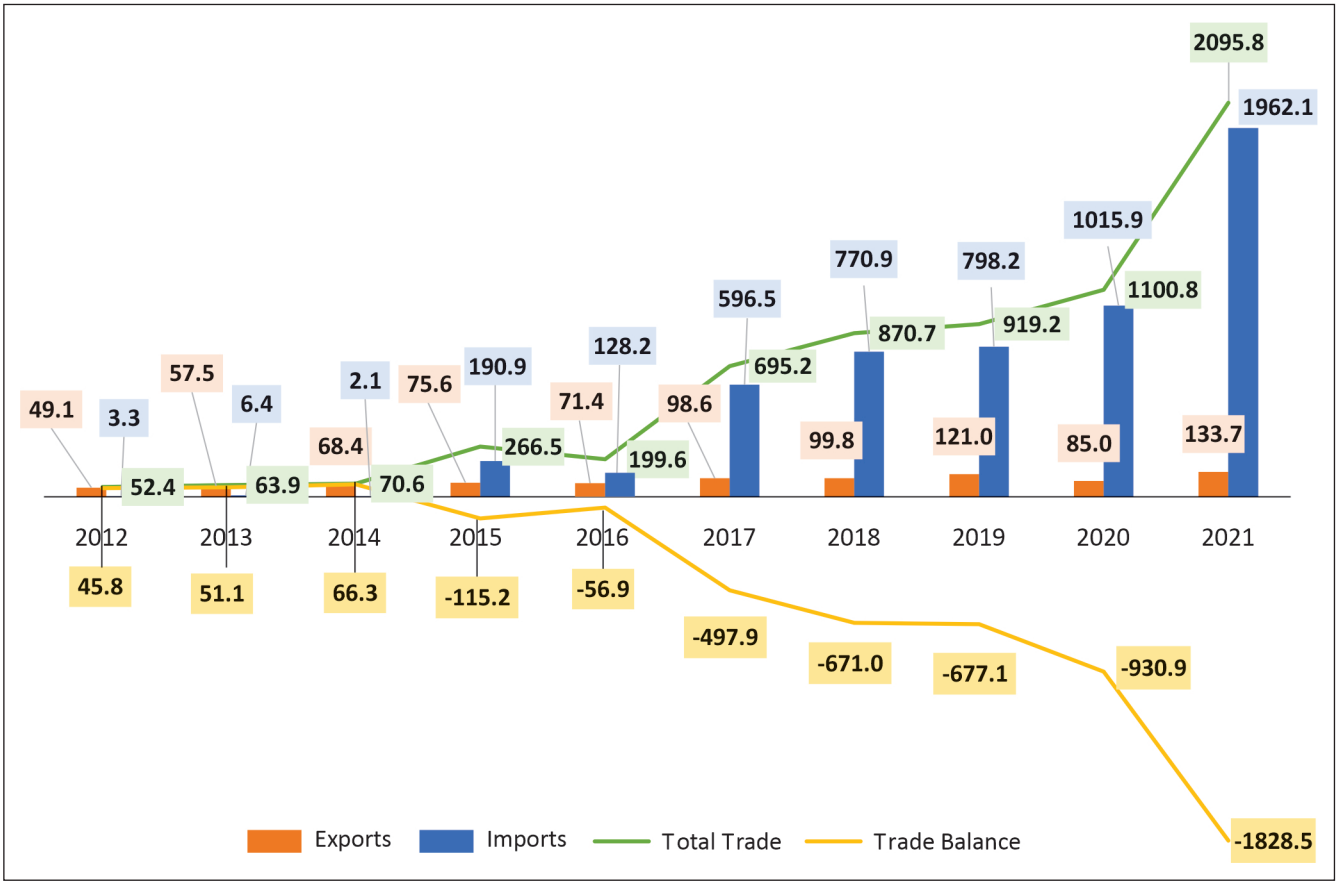
Source: ITC Trade Map and India Exim Bank Research

India-Bolivia Bilateral Merchandise Trade Relations

Bilateral relations between India and Bolivia have progressed rapidly in recent years. The bilateral exchanges and development of trade and investment relations between the two countries look promising for the purpose of enhancing mutually beneficial cooperation.

Trade between India and Bolivia has grown significantly in the past decade. India's exports more than doubled from US$ 49.1 million in 2012 to US$ 133.7 million in 2021 **(Chart 3.2)**. India's imports from Bolivia have increased from just US$ 3.3 million in 2011 to almost US$ 2 billion in 2021 implying a compounded annual growth rate of over 80%. Most of the increase in imports arises from imports of unwrought gold which comprises 99.7% of India's imports from Bolivia. While, trade relations have expanded impressively, they remain highly imbalanced with trade deficits widening severely for India.

Chart 3.3: India's Bilateral Trade with Bolivia (US$ million)



Source: ITC Trade Map and India Exim Bank Research

India's Merchandise Exports to Bolivia

India is a significant supplier for vehicles to Bolivia, comprising 47.4% of India's total exports to Bolivia **(Table 3.4)**. Other major export commodities include pharmaceutical products (35.7% share in total exports to Bolivia), rubber and its articles (3.4%), machinery and mechanical appliances (2%) and organic chemicals (2%), among others.

Table 3.4: India's Major Export Items to Bolivia (US$ million)

HS Code	Product Label	2019	2020	2021	Share in 2021 (%)
Total	**All products**	**121.0**	**85.0**	**133.7**	**100.0**
87	Vehicles other than railway or tramway	51.1	32.4	63.4	47.4
30	Pharmaceutical products	24.8	20.4	47.7	35.7
40	Rubber and articles thereof	4.8	3.1	4.5	3.4
84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	9.9	2.0	2.7	2.0
29	Organic chemicals	1.9	2.3	2.6	2.0
38	Miscellaneous chemical products	7.2	2.5	2.0	1.5
73	Articles of iron or steel	8.5	14.3	1.7	1.2
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical devices	2.2	1.4	1.6	1.2
39	Plastics and articles thereof	0.8	0.6	1.6	1.2
85	Electrical machinery and equipment	2.5	0.9	1.0	0.7
76	Aluminium and articles thereof	0.6	0.9	0.8	0.6
13	Lac; gums, resins and other vegetable saps and extracts	0.4	0.3	0.7	0.5
69	Ceramic products	0.0	0.1	0.4	0.3
28	Inorganic chemicals	2.9	0.6	0.4	0.3
32	Tanning or dyeing extracts	0.4	0.3	0.3	0.3

Source: ITC Trade Map and India Exim Bank Research

India's Merchandise Imports from Bolivia

Natural or cultured pearls, precious or semi-precious stones, precious metals make up almost the entirety of India's imports from Bolivia, with a massive share of over 99% **(Table 3.5)**. There were minor imports of Salt, plastering materials and lime and cement (0.4%) and copper and its articles (0.02%).

Table 3.5: India's Major Import Items from Bolivia (US$ million)

HS Code	Product Label	2019	2020	2021	Share in 2021 (%)
Total	**All products**	**798.2**	**1,015.9**	**1,962.1**	**100.0**
71	Natural or cultured pearls, precious or semi-precious stones, precious metals	795.7	1,013.7	1,953.1	99.5
25	Salt; sulphur; earths and stone; plastering materials, lime and cement	1.6	2.0	7.9	0.4
74	Copper and articles thereof	0.1	0.0	0.5	0.02

Source: ITC Trade Map and India Exim Bank Research

Opportunities for Enhancing Trade Engagement Between India and Bolivia

Bolivia accounted for only 4.2% of India's total exports to and 27.8% of total imports from the region. However, potential exists to further enhance India's exports, based on the import demand in Bolivia, and

India's export capability. **Table 3.6** presents Bolivia's major import items, in terms of 2-digit HS code, and India's share in Bolivia's global imports of these items. As may be seen from the table, India has not achieved a healthy share in majority of Bolivia's global imports during 2021. India's share in Bolivia's global imports of all major items is marginal, which would serve to highlight the potential to further enhance these exports to Bolivia, in line with the huge import demand in the country. At the same time some of these items are also amongst India's leading global export items, which highlight India's export capability. Based on the pre-defined criteria, the potential export items from India to Bolivia would thus include:

- HS-27 – Mineral fuels and mineral oils and products of their distillation
- HS-84 – Machinery, mechanical appliances, nuclear reactors and boilers
- HS-85 – Electrical machinery and equipment
- HS-72 – Iron and steel
- HS-39 – Plastics and articles thereof
- HS-38 – Miscellaneous chemical products
- HS-73 – Articles of iron and steel
- HS-90 – Optical, photographic, measuring, medical or surgical devices
- HS-76 – Aluminum and articles thereof

Table 3.6: Bolivia's Major Global Imports and India's Share, 2021

HS Code	Product Label	Bolivia Total Imports	India's Exports to Bolivia	India's Share in Bolivia's Total Imports	India's Exports to World	Share in India's Total Exports
Total	**All products**	**9559.1**	**133.7**	**1.4%**	**394813.7**	**100.0%**
27	Mineral fuels, mineral oils	2231.5	0.0	0.0%	56400.6	14.3%
84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	1007.9	2.7	0.3%	24165.8	6.1%
87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	902.0	63.4	7.0%	18897.2	4.8%
85	Electrical machinery and equipment	576.5	1.0	0.2%	18836.2	4.8%
72	Iron and steel	570.1	0.3	0.1%	21199.5	5.4%
39	Plastics and articles thereof	532.7	1.6	0.3%	8555.2	2.2%
38	Miscellaneous chemical products	359.5	2.0	0.6%	6473.7	1.6%
30	Pharmaceutical products	256.8	47.7	18.6%	19460.5	4.9%
73	Articles of iron or steel	241.8	1.7	0.7%	8361.2	2.1%
40	Rubber and articles thereof	177.5	4.5	2.5%	4452.0	1.1%
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical devices	168.7	1.6	1.0%	3912.9	1.0%
21	Miscellaneous edible preparations	168.2	0.0	0.0%	1070.2	0.3%

HS Code	Product Label	Bolivia Total Imports	India's Exports to Bolivia	India's Share in Bolivia's Total Imports	India's Exports to World	Share in India's Total Exports
11	Products of the milling industry; malt; starches; inulin; wheat gluten	125.6	0.0	0.0%	576.0	0.1%
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	119.7	0.1	0.0%	2954.7	0.7%
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations	114.3	0.1	0.1%	2158.8	0.5%
76	Aluminium and articles thereof	95.0	0.8	0.9%	9063.9	2.3%
29	Organic chemicals	94.3	2.6	2.8%	21184.1	5.4%
94	Furniture; bedding, mattresses	88.3	0.1	0.1%	2785.5	0.7%

Source: ITC Trade Map and India Exim Bank Research

India-Chile Bilateral Merchandise Trade Relations

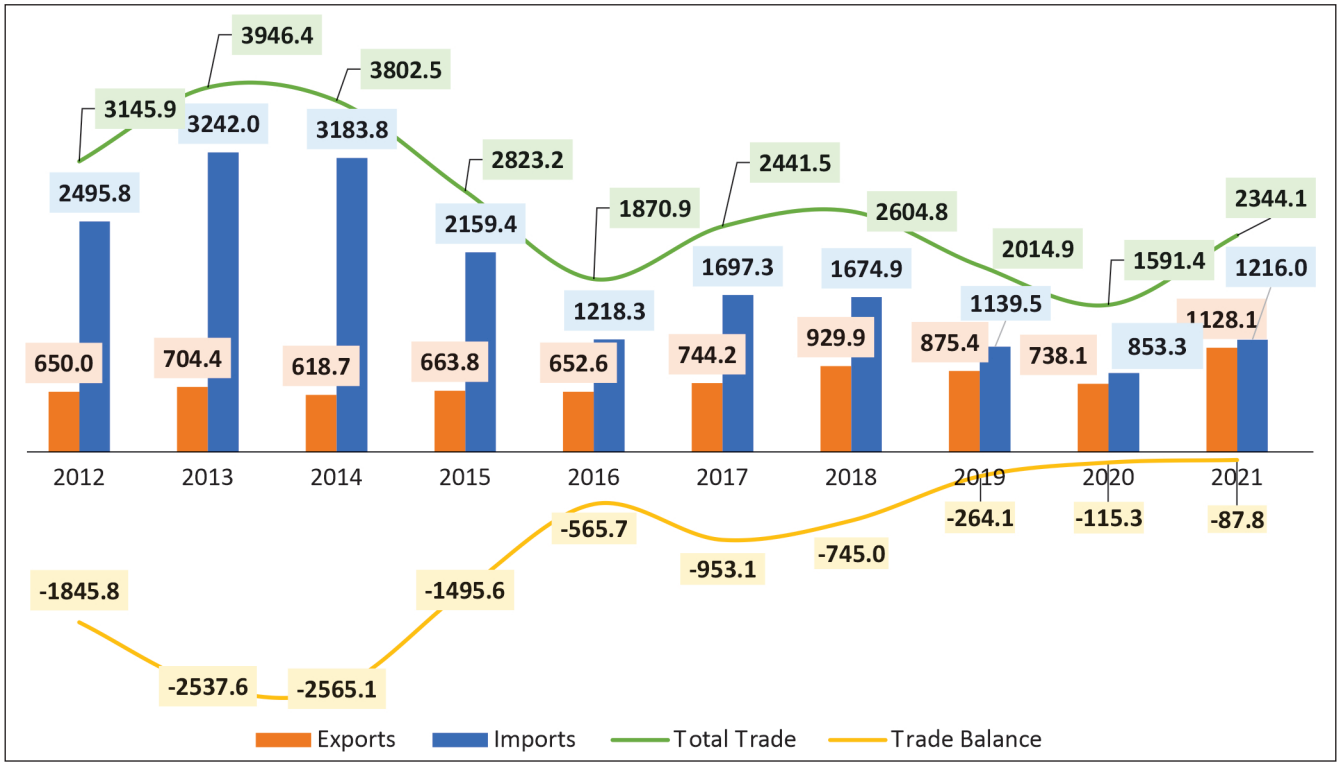
India and Chile signed a Framework Agreement to promote economic cooperation in January 2005 which eventually transformed into a Preferential Trade Agreement (PTA) that came into force in 2007. Initially, India provided fixed tariff preferences in the range of 10% to 50% on 178 tariff lines at the 8-digit level to Chile, with the latter reciprocating with 10% to 100% concessions on 296 tariff lines at the 8-digit level[9].

In 2017, India and Chile expanded the existing PTA, with India offering concession on 1,031 tariff lines and Chile offering concession on 1,798 tariff lines. The major products covered in India's offer are meat and meat products, fish and fishery products, vegetable oils, iron and copper ores and concentrates, organic and inorganic chemicals, pharmaceuticals, plastic and rubber and articles thereof, articles of iron, steel, wood and paper. Chile's end of the agreement concerns agricultural products, organic and inorganic chemicals, pharmaceutical products, rubber and plastic articles, textiles and apparel, machinery and equipment as well as articles of iron and steel[10].

Trade between India and Chile has grown rapidly in the 21st century, but while trade growth has been impressive it was highly imbalanced with India running large trade deficits against Chile. Total trade between the two countries peaked in 2013 at US$ 3.9 billion while India's deficit reached over US$ 2.5 billion. However, following a period of contraction between 2013 and 2016, trade between the two partners has become relatively equitable **(Chart 3.4)**. While India's imports from Chile continued to contract from 2013 to 2019 (barring a lone reversal in 2017), Indian exports to Chile have grown at a compounded annual growth rate of over 8%. The primary reason for decline in India's imports from Chile has been the contraction in India's import demand for copper ores and concentrates which have a three-quarters share in India's total imports from Chile. The rise in India's exports to Chile is likely a result of positive effects from the recently expanded PTA as a result of which exports have expanded in various categories like vehicles, pharmaceutical products, machinery, textiles and plastics, among others. In 2021, India's exports to Chile amounted to US$ 1.1 billion while imports were US$ 1.2 billion this represented a 52.8% growth in Indian exports to Chile and a 42.5% growth in Chile's exports to India over 2020. India achieved its highest ever level of exports to Chile in 2021 and the trade deficit also narrowed to its lowest level since 2002.

[9] Ministry of Commerce and Industry, India Chile PTA (Preferential Trade Agreement)
[10] Ministry of Commerce and Industry, Expansion of India-Chile Preferential Trade Agreement

Chart 3.4: India's Bilateral Trade with Chile (US$ million)



Source: ITC Trade Map and India Exim Bank Research

India's Merchandise Exports to Chile

Transport vehicles make up the largest share of India's exports to Chile with a share of 38% in 2021 **(Table 3.7)**. This is followed by pharmaceutical products (13.6% share in total exports), machinery and mechanical appliances (4.8%), other-made up textile articles (4.5%) and plastic and its articles (3.5%), among others.

Table 3.7: India's Major Export Items to Chile (US$ million)

HS Code	Product Label	2019	2020	2021	Share in 2021 (%)
Total	**All products**	**875.4**	**738.1**	**1,128.1**	**100.0**
87	Vehicles other than railway or tramway	231.7	208.1	428.4	38.0
30	Pharmaceutical products	96.2	111.2	153.2	13.6
84	Machinery and mechanical appliances	26.8	18.4	54.6	4.8
63	Other made-up textile articles	41.8	31.9	51.2	4.5
39	Plastics and articles thereof	23.1	27.1	40.0	3.5
42	Articles of leather	29.3	20.8	33.2	2.9
52	Cotton	17.5	19.1	28.2	2.5
29	Organic chemicals	30.8	31.5	28.2	2.5
85	Electrical machinery and equipment	17.7	40.6	26.4	2.3
62	Articles of apparel and clothing accessories, not knitted or crocheted	35.2	22.0	23.4	2.1
73	Articles of iron or steel	106.3	36.4	22.7	2.0

HS Code	Product Label	2019	2020	2021	Share in 2021 (%)
55	Man-made staple fibres	14.3	13.0	18.7	1.7
72	Iron and steel	15.3	9.5	18.1	1.6
61	Articles of apparel and clothing accessories, knitted or crocheted	15.8	10.5	17.0	1.5
56	Wadding, felt and nonwovens, special yarns; twine, cordage, ropes and cables	19.3	11.2	16.1	1.4

Source: ITC Trade Map and India Exim Bank Research

India's Merchandise Imports from Chile

Ores, slag and ash make up the bulk of India's imports from Chile with a share of 73% in 2021 **(Table 3.8)**. This is followed by edible fruits and nuts (11.1% of India's total imports from Chile), wood pulp and related products (4.1%), inorganic chemicals (4%), natural or cultured pearls, precious or semi-precious stones, precious metals (2.5%) and iron and steel (1%).

Table 3.8: India's Major Import Items from Chile (US$ million)

HS Code	Product Label	2019	2020	2021	Share in 2021 (%)
Total	**All products**	**1,139.5**	**853.3**	**1,216.0**	**100.0**
26	Ores, slag and ash	809.9	580.6	888.1	73.0
08	Edible fruit and nuts; peel of citrus fruit or melons	74.4	69.7	134.8	11.1
47	Pulp of wood or of other fibrous cellulosic material	36.2	31.4	50.0	4.1
28	Inorganic chemicals	72.4	64.4	48.3	4.0
71	Natural or cultured pearls, precious or semi-precious stones, precious metals	56.4	15.7	30.1	2.5
72	Iron and steel	20.7	14.1	12.5	1.0
76	Aluminium and articles thereof	9.2	9.9	9.5	0.8
27	Mineral fuels, mineral oils	0.0	2.0	5.9	0.5
31	Fertilisers	1.1	21.4	5.1	0.4
48	Paper and paperboard	7.3	15.5	4.6	0.4
74	Copper and articles thereof	5.9	3.7	4.4	0.4
12	Oil seeds and oleaginous fruits	5.6	3.0	4.1	0.3

Source: ITC Trade Map and India Exim Bank Research

Opportunities for Enhancing Trade Engagement Between India and Chile

Chile accounted for 45.8% of India's total exports to and 16.7% of total imports from the region. Potential exists to further enhance India's exports, based on the import demand in Chile, and India's export capability. **Table 3.9** presents Chile's major import items, in terms of 2-digit HS code, and India's share in Chile's global imports of these items. As may be seen from the table, India has not achieved a healthy share in majority of Chile's global imports during 2021. India's share in Chile's global imports of all major items is marginal, which would serve to highlight the potential to further enhance these exports to Chile, in line with the huge

import demand in the country. At the same time some of these items are also amongst India's leading global export items, which highlight India's export capability. Based on the pre-defined criteria, the potential export items from India to Chile would thus include:

- HS-27 – Mineral fuels and oils and products of their distillation
- HS-84 – Machinery, mechanical appliances, nuclear reactors and boilers
- HS-85 – Electrical machinery and equipment
- HS-39 – Plastics and articles thereof
- HS-72 – Iron and Steel
- HS-10 – Cereals
- HS-90 – Optical, photographic, measuring, medical or surgical devices
- HS-40 – Rubber and articles thereof
- HS-38 – Miscellaneous chemical products

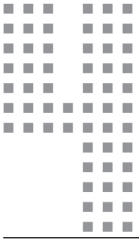
Table 3.9: Chile's Major Import Item's and India's Share in Chile's Imports, 2021

HS Code	Product Label	Chile Total Imports (US$ million)	India's Exports to Chile (US$ million)	India's Share in Chile's Total Imports	India's Exports to World (US$ million)	Share in India's Total Exports
Total	**All products**	**95168.5**	**1128.1**	**1.2%**	**394813.7**	**100.0%**
27	Mineral fuels, mineral oils and products of their distillation	17576.4	1.2	0.0%	56400.6	14.3%
84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	10962.9	54.6	0.5%	24165.8	6.1%
85	Electrical machinery and equipment and parts thereof	9857.4	26.4	0.3%	18836.2	4.8%
87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	9724.9	428.4	4.4%	18897.2	4.8%
39	Plastics and articles thereof	3586.4	40.0	1.1%	8555.2	2.2%
30	Pharmaceutical products	2489.5	153.2	6.2%	19460.5	4.9%
72	Iron and steel	2431.3	18.1	0.7%	21199.5	5.4%
02	Meat and edible meat offal	2380.8	0.0	0.0%	3384.0	0.9%
73	Articles of iron or steel	1886.1	22.7	1.2%	8361.2	2.1%
10	Cereals	1764.1	0.9	0.1%	12350.1	3.1%
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical	1702.7	10.6	0.6%	3912.9	1.0%
23	Residues and waste from the food industries; prepared animal fodder	1410.3	10.5	0.7%	1896.9	0.5%
61	Articles of apparel and clothing accessories, knitted or crocheted	1399.1	17.0	1.2%	7870.3	2.0%
40	Rubber and articles thereof	1395.4	15.5	1.1%	4452.0	1.1%

HS Code	Product Label	Chile Total Imports (US$ million)	India's Exports to Chile (US$ million)	India's Share in Chile's Total Imports	India's Exports to World (US$ million)	Share in India's Total Exports
38	Miscellaneous chemical products	1288.5	8.7	0.7%	6473.7	1.6%
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals	1273.9	3.1	0.2%	2409.7	0.6%
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings	1267.2	6.1	0.5%	2785.5	0.7%
29	Organic chemicals	1201.7	28.2	2.3%	21184.1	5.4%
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations	1132.1	9.7	0.9%	2158.8	0.5%
62	Articles of apparel and clothing accessories, not knitted or crocheted	1015.4	23.4	2.3%	7332.9	1.9%

Source: ITC Trade Map and India Exim Bank Research

Chapter



Lithium Industries of Argentina, Bolivia and Chile

The South American countries of Argentina, Bolivia and Chile, known for their vast lithium reserves, encompass the Lithium Triangle. This triangular area, situated within the Andean plateau, holds the majority of the world's lithium resources and has become a critical hub for lithium extraction and production.

Lithium, a light and highly reactive metal, has gained immense importance in recent years due to its crucial role in the production of lithium-ion batteries. These batteries power a wide range of electronic devices, from smartphones and laptops to electric vehicles and energy storage systems. As the world transitions towards clean energy and electric mobility, the demand for lithium has skyrocketed, making the Lithium Triangle nations pivotal players in the global lithium market.

The Lithium Triangle countries possess unique geological conditions that have resulted in the accumulation of significant lithium deposits. The Salar de Uyuni in Bolivia, the Hombre Muerto in Argentina, and the Salar de Atacama in Chile are among the world's largest salt flats, where lithium is found in concentrated brine solutions. These salt flats provide an abundant and accessible source of lithium, making the Lithium Triangle a hotbed for lithium extraction and processing.

Each of the Lithium Triangle nations has its own approach to lithium production. Bolivia, with its vast lithium reserves, has sought to develop its lithium industry under state control to maximize national benefits. Argentina has encouraged foreign investments and partnerships to boost its lithium production capacity. Chile, on the other hand, has a well-established lithium industry and is a major global producer, utilizing both brine extraction and lithium-rich rock mining.

The Lithium Triangle's strategic location, extensive lithium reserves, and existing infrastructure have attracted international attention and investments. Major global players in the lithium sector, as well as countries aiming to secure lithium supplies for their energy transitions, have engaged in collaborations and partnerships with the Lithium Triangle nations.

However, the exploitation of lithium resources in the Lithium Triangle also raises environmental and social concerns. The extraction of lithium requires substantial amounts of water, which can impact local ecosystems and strain water resources in arid regions. Additionally, ensuring sustainable resource management and social responsibility in the lithium industry is essential to minimize environmental impacts and promote the well-being of local communities.

As the demand for lithium continues to grow, the Lithium Triangle remains a significant region that shapes the global lithium market and plays a vital role in advancing clean energy technologies and sustainable development worldwide.

Argentina's Lithium Industry

Argentina produces more than 30 different types of minerals, including gold, silver, lithium, crushed stone, sand, lead, limestone, boulders, zinc, salt, borates, clays and coal, among others. Copper was the second most important mineral till 2013, but the country is not producing it since the closure of the Bajo La Alumbrera mine in 2018.

In 2021, mining accounted for over 4% of the goods exported from Argentina amounting to more than US$ 3.2 billion. Mining also employs more than 33,000 people directly, and this employment is created in regions far from the main cities in the country. Within mining, the metal segment (the most important) is, together with hydrocarbons, the sector with the highest remuneration and formality rates in the country.

In 2022, Argentina is ranked 3rd in terms of lithium reserves and 4th in lithium production globally. Argentina's lithium resources are vital to its economy and the global supply chain. The country has attracted a number of major players from the mining and battery chemicals sectors in recent years. In addition to being geologically rich, Argentina also has one of the most favorable legal regimes in the region.

The mineral industry in Argentina comprises of both domestic and foreign private and public companies. There are no restrictions on foreign investments and ownership of projects and companies engaged in mineral exploration and extraction. Argentina's sole copper producer is a joint venture between firms from Switzerland and Canada. There is significant presence of companies from United States, Australia and Japan. In recent times, China has significantly increased its presence in Argentina's mining sector, particularly in lithium mines. GFL International Co. Ltd., China's largest integrated lithium producer became the largest shareholder of Lithium Americas Corp. which was developing the Cauchari-Olaroz lithium brine project in Argentina.

Lithium Production and Potential in Argentina

Argentina ranks 2nd in the world in terms of total resources of lithium with an estimated 20 million tons. It ranks 4th globally in lithium production with output increasing from 5,970 tons in 2020 to 6,200 tons in 2021. Argentina's lithium operations are concentrated in three provinces: Salta, Catamarca and Jujuy.

The Lithium industry in Argentina is expanding rapidly. There are currently 2 production operations in Argentina with a combined annual capacity of 37,500 tons annually. There are 20 projects currently in the Advanced Exploration stage or further. Several new projects are expected to start producing over the next few years. One will be operated by Eramine, an Argentine subsidiary of French Eramet, which together with China's Tsingshan is developing a project in the Salar Centenario Ratones in the province of Salta. With the start-up of the projects that are under construction and expansion of current operations, Argentina can increase its current production six-fold in the next five years. According to a report by J P Morgan, Argentina is forecasted to go from supplying 6% of the world's lithium in 2021 to 16% by 2030, overtaking Chile as the number two lithium producer in the world by 2027, behind only Australia.

Between 2017-2020, the lithium sector attracted investment of US$ 1.2 billion, a large part of which has gone towards construction of new projects or extension of existing projects as well as exploration. Argentina has

been forerunner globally in lithium exploration budgets. A large number of foreign companies are involved in Argentina's lithium operations including Liven Corp., Lithium Americas (US), Allkem Ltd. (Australia), Toyota Tsusho (Japan), Ganfeng Lithium Co. Ltd. (China), Eramet (France), POSCO (S. Korea)[11].

While at present the Argentina's position in the lithium supply chain is primarily that of a raw materials supplier, a number of initiatives to develop forward and backward linkages around lithium have been undertaken. The initiatives to develop backward linkages focus on geological studies to improve quantification and knowledge about the reserves; extraction and processing technologies to limit the environmental impact and improve economic feasibility; lithium products to diversify into newer lithium products and local suppliers to improve their capabilities in logistics, infrastructure maintenance etc. The initiatives to develop forward linkages mainly revolve around production of batteries with focus on processing the lithium carbonate within the country. The goal of state-owned company JEMSE is to set up an industrial complex in Jujuy that covers all stages of the Lithium-ion battery value chain. In addition, a wide array of research and development projects related to battery technology optimization and recycling activities[12].

Regulatory Framework and Government Policy

Argentina's mining-friendly policies and low royalty rates have made it Latin America's premier destination for foreign investment looking for lithium projects, fueling projections that the country may surpass Chile as the world's second-largest lithium producer. Argentina has treated lithium like any other metal, open to be explored and exploited by any private company like all other minerals.

The regulatory framework for Argentina's mineral sector is governed by the Mining Code, 1886 as per which all mineral deposits are properties of the State. After the constitutional reforms of 1994, the mineral resources became the property of the provinces in which they are located. The provinces (of which there are a total 23) control mining activities in their respective jurisdictions. These provinces have their individual mining procedural laws and are responsible for granting exploration and extraction rights, collecting royalties and environmental regulations. The rules and procedures relating to the grant, maintenance, transfer and withdrawal of mining rights are established by Argentina's Mining Code. The Code creates a concession system under which exploration permits and concessions for exploitation are granted subject to payment of an annual fee and compliance with investment commitments with the requirement to keep the mine active.

The environmental requirements with regards to mining are set out in the Environmental General Protection Act and Law No. 24,585 incorporated into the Mining Code. Mining firms must submit an environmental impact assessment (EIA) report to the provincial authority if it seeks to conduct prospection, exploration or exploitation activities. If the EIA meets the standards, the authority issues an Environmental Impact Statement (EIS) that allows the applicant to carry out its proposed activities. The EIS is renewed after every 2 years, subject to compliance of the conditions and requirements[13].

The Mining Investment Law 1993 grants several benefits to investors. The law provides tax stability for a period of 30 years. It also allows for a 0% tax on imports of capital goods and raw materials for mining purposes. It promotes promotion of exploration activities by allowing for double income tax deduction of exploration expenditures until the completion of feasibility studies. It also sets a 3% upper bound for

[11] Lithium in Argentina, Secretaría de Minería, Ministerio de Desarrollo Productivo, Argentina
[12] Martín Obaya, Resources Policy, https://doi.org/10.1016/j.resourpol.2020.101912
[13] Mining in Argentina – Reasons to Invest, Secretaría de Minería, Ministerio de Desarrollo Productivo, Argentina

provincial authorities. In 2021, Argentina created the 'Investment Promotion Regime for Exports' which provides benefits to investors making direct investments greater than US$ 100 million by guaranteeing access to foreign currency for repayment of principal, interest payments and profit and dividend distribution.

Conclusively, Argentina's reputation in the lithium industry benefits from regulatory lenience. Private companies are free to control the production of lithium, with the government collecting taxes and royalties. Argentina's national and provincial mining laws and regulations are seen as stable and pro-business.

Argentina's lithium industry is vulnerable to the same environmental considerations that have limited the sector's expansion in Chile. Specifically, there are widespread concerns about the heavy water use in the evaporation processes used to produce lithium from brine in Argentina's salt flats. Fortunately, recent innovations, such as Direct Lithium Extraction (DLE), have raised hopes of dramatically reducing water use. That would help Argentina avoid tensions with local communities and meet the sustainability requirements of lithium end users, including EV manufacturers and their customers.

While DLE would benefit Argentina's lithium industry, however, other technological changes would be less welcome. Fears of high-priced lithium are leading to research into alternative battery technologies that would reduce the need for this mineral. That means that the predicted widespread adoption of EVs might not guarantee sustained demand for Argentina's lithium.

Bolivia's Lithium Industry

Mining is one of Bolivia's prominent economic activities. Mining has been carried out in Bolivia from the early 16th century. In 2020, mining accounted for 22% of Bolivia's exports at US$ 1.5 billion[14]. Bolivia is globally major supplier of ores and mineral concentrates. Mining and quarrying activities accounted for 9% of the GDP in 2017 and employed nearly 135,000 workers. As of 2017, it had a 6% share in global production of tin and a 5% share in silver. It is also a significant producer of tungsten, zinc, lead and antimony. It possesses 21% of the world's antimony reserves, a mineral used in the manufacture of semiconductor devices.

Bolivia houses the world's largest lithium resource at an estimated 21 million tons, which is more than a 21% of the estimated global resources of 98 million tons[15]. Most of Bolivia's reserves are concentrated in Salar de Uyuni. However, Bolivia is currently not producing lithium on a commercial scale.

Developing its lithium assets has been an objective of the state for many years. Attempts were made to privatize the industry in 1990s, but they failed. Under new administration from 2006, a more proactive role for the state was outlined through setting up state-owned lithium company and nationalization of the country's mines. However desired results were not achieved.

After a new government was elected in 2020, a different approach has been adopted that seeks to balance the role of public and private sector. The new administration has invited private companies to test Direct Lithium Extraction (DLE) technology, a faster and more environment-friendly method in comparison to evaporation in Bolivia's salt flats.

[14] US Department of Commerce, International trade Administration, Country Commercial Guides, Bolivia – Mining Sector
[15] USGS Commodity Summaries, 2022

Regulatory Framework and Government Policy

Bolivia adopted a new constitution in 2009 which stated natural resources to be of a strategic nature and of public importance for the country's development. Further it stated natural resources to be a property and direct domain of the Bolivian people with their administration the sole right of the State[16].

Bolivia passed the Law of Mining and Metallurgy in 2014 to make the mining rules more in line with the new constitution. The law establishes the guidelines and procedures for granting, holding and revoking mining rights; for the project development and for responsible, planned and sustainable conduct of mining and metallurgical activities. The authority responsible for exercising these powers is the Jurisdictional Mining Administrative Authority (AJAM) under the Ministry of Mines and Metallurgy.

In 2017, the government put in force a new law that created the Yacimientos de Litio Bolivianos (YLB), the National Public Company for Bolivian Lithium Deposits to replace the GNRE. Its objective is to promote lithium production in the country and carry out tasks to develop evaporate resources like exploration and mining. It is also responsible for creating processing protocols for evaporate resources related, which includes guidelines for production and commercialization of products like lithium carbonate, lithium chloride, lithium hydroxide etc.

Environmental regulations concerning mining are outlines in the Environmental Law (1992), and the Environmental Regulations for Mining Activities (1997). The law requires mining companies to obtain an environmental license before commencing operations. Prospecting and Exploration are exempt from submission of Environmental Baseline Audit and an Environmental Impact Study, however for exploitation and/or procession both are required to be filed. The Bolivian Mining Law also requires consultations with local communities before any mining exploitation activity. Mining Activities are subject to General Taxes including the Value Added Tax, Transaction Tax, the Company Income Tax in addition to Mining royalties as well as a mining rights tax.

Issues

The extraction of lithium in Bolivia by foreign companies has been a contentious issue for a long time. The FMC Corp, (now Livent) was driven out of the country after protests by several Bolivian organizations. In 2018, Bolivia entered an agreement in which state-owned YLB was to partner with Germany-based ACI Systems to develop the Salar de Uyuni and build a lithium hydroxide plant as well as a factory for EV batteries in Bolivia[17]. However, the agreement was annulled almost a year later. Bolivia faces capacity and financial constraints which prevent it from independently developing its lithium mines and processing facilities.

The laws and regulations concerning mining are particularly onerous in Bolivia. The process of transition of mining companies to the new types of contracts in which they need to form a joint venture with COMIBOL remains unclear. The law establishes that extraction and processing as a complete domain of the state and only leaves out the industrialization of lithium open to private and foreign agents.

The reserves in Uyuni have high Mg/Li ratios along with higher rainfall and slower evaporation rates. This the current technology of lithium extraction less economically viable, as a result the success of DLE becomes crucial.

[16] ECLAC, Governance of Strategic Minerals in Latin America: The Case of Lithium
[17] USGS, The Minerals Industry of Bolivia

Chile's Lithium Industry

Chile is a major supplier of a number of raw materials globally. In 2021, Chile reached a production of 5.62 million tons of fine copper. The 26% market share of global copper production and new greenfield and brownfield projects will allow Chile to maintain this historical position. Other production highlights in 2021 include 49.4 thousand tons of molybdenum, 34.2 tons of gold, 1,383 tons of silver, and 162.4 thousand tons of lithium carbonate equivalent (LCE).

The mining investment project pipeline of Chile for the 2022-2031 period considers 53 initiatives valued at US$ 73.6 billion. Of the total amount, investments of US$ 12.7 billion have already materialized, with a total of US$ 46.3 billion, 62.9% of the portfolio, remaining to be invested during the five-year period 2022-2026, and the remainder between 2027 and 2031. Thus, 58% of the portfolio will come into operation between 2021 and 2026, and 12 projects, equivalent to 41% of the portfolio, will materialize beyond 2026.

In terms of exploration, in 2022 the exploration budget in Chile reached US$ 713.2 million and comprised a 5.5% share of the global budget. This represents an increase of 30% in relation to 2021, and once again positions Chile as the main exploration destination in Latin America, and the fourth country in terms of exploration budget allocation globally.

The leading companies in the mineral industry are state-owned CODELCO, which is the largest copper producer in the world and private companies include CMP, Molymet and SQM. Foreign players include BHP, Albermarle Corporation, Anglo American, Antofagasta Minerals and Yamana Gold.

As part of the Lithium Triangle, Chile possesses the 3rd largest reserves of lithium in the world at close to 9.8 million tons. It is currently the 2nd largest producer of the metal behind Australia, with an estimated annual output of 26000 tons in 2021. Chile's lithium production is principally derived from two brine operations in Salar de Atacama, which has some of the highest lithium concentrations in the world. Evaporation time is one of the key determinants of production costs and Atacama Salar's evaporation rates are the highest in the lithium industry. The production is dominated by two companies, the Albermarle Corporation, a US firm and Chile's Sociedad Química y Minera de Chile S.A. (SQM). CODELCO has also planned to start lithium exploration at Salar de Maricunga in 2022. However, given the quality and cost effectiveness of Atacama lithium, there has been worldwide interest among lithium producers for Chile's reserves. In December 2018, the Tianqi Corporation of China bought a 23.8% stake in SQM for US$4.1 billion, which was the largest deal for a lithium asset.

Chile mostly produces and exports unrefined lithium. Its main products are lithium carbonate and lithium hydroxide. However, the government wants the industry to move up the value chain. In order to achieve this, the government has attempted to offer guaranteed supply of lithium at discounted prices in exchange for commitments to building battery parts in Chile. The government had in 2019 also announced a US$ 1.8 billion investment pipeline for lithium projects.

Regulatory Framework and Government Policy

Legislation in Chile establishes state as the owner of the country's mineral resources with the power to award concession for the exploration and exploitation of these resources with the exception of hydrocarbons, lithium and other minor minerals. The legal framework for mining in Chile is based on the Organic Constitutional Law on Mining Concession and the Chilean Mining Code[18].

[18] USGS, The Mineral Industry of Chile 2018

COCHILCO was established with the purpose of advising the government on matters primarily concerning copper and other metals as well as industrial minerals mining. The national mining corporation, ENAMI was established in 1960 to promote small and medium sized private sector mining in Chile by offering incentives to correct market failures and providing services in the technical, metallurgical production, financial and trading domain to improve the competitiveness of firms.

In 2016, a new law came into force that established a new legal framework for FDI and created the Foreign Investment Promotion Agency, also known as InvestChile which is responsible for attracting and promoting foreign direct investment into Chile.

Chile defines lithium as a strategic mineral of national interest, as a result of its use in nuclear fusion. Its property is under the control of 3 state institutions: Corporation for the Promotion of Production (CORFO) in Antofagasta region for Salar de Atacama, CODELCO in Salar de Pedernales and Maricunga (Atacama region) and ENAMI in Salar de Aguilar. These institutions deliver special lithium operation contracts (CEOL) or administrative lease contracts for extraction of per-specified amounts in a given time period to private actors.

The decree of 1979, which establishes the strategic nature lithium, requires the authorization of Chilean Commission of Nuclear Energy (CCheN). The Organic Law of Mining concessions added lithium as a non-concessionable substance. As a result, exploration and/or exploitation of lithium reserves can be only carried out by the state directly or by state enterprises or special operating contract concessions[19].

Issues

Regulatory Bottlenecks are a major factor holding back Chile's lithium industry. Chile used to be the number one producer of the metal however, it has been taken over by Australia. Chile imposes strict restrictions on private investments in exploration and exploitation of lithium reserves. The only way a private company can mine lithium in Chile is through partnering with CORFO by obtaining the special permit, CEOL. The constitutional reform currently underway has further increased uncertainty regarding the future role of private sector in the lithium mining industry.

In addition, there are environmental concerns regarding water which is used intensively in brine extraction where it is allowed to evaporate to obtain liquids with higher concentration of lithium. This has sparked conflict with local indigenous communities who argue that this has reduced the water available for farming, given that the region is one of the driest on Earth.

[19] Ministry of External Affairs, Economic Diplomacy Division, Survey of Lithium Market – Chile, 2019

Chapter

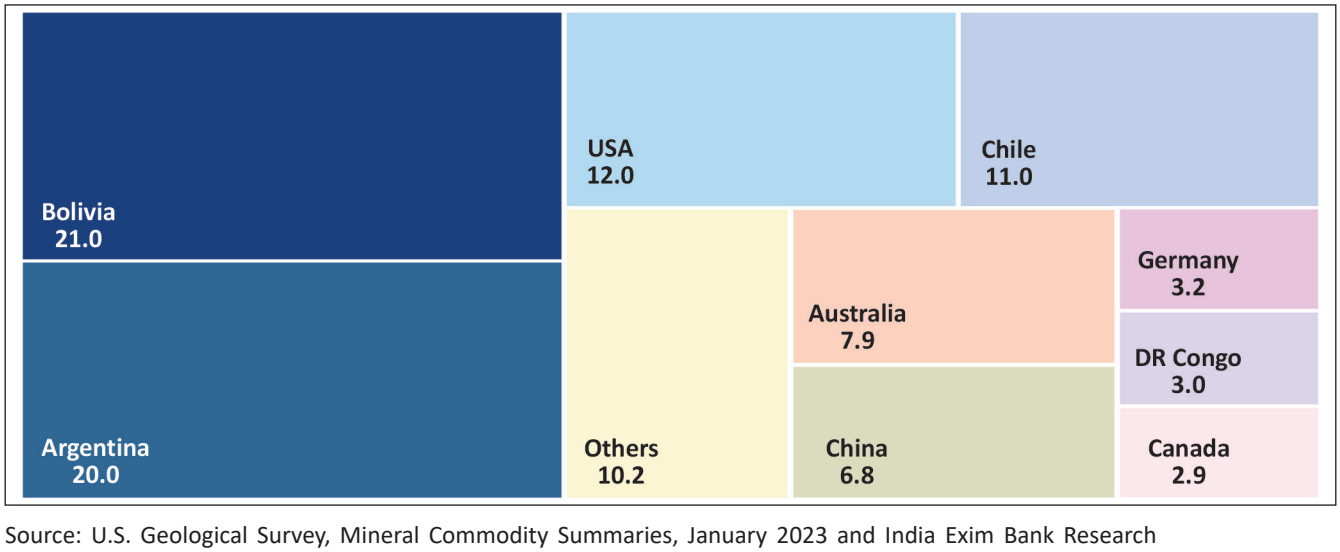
Global Lithium Scenario

Reserves and Resources

As per the US Geological Survey, the total estimated global resources of lithium were 98 million tons in 2022[20]. The total identified lithium resources have increased by 10.1% from 89 million tonnes in 2021 as a result of continuing exploration across the world. Mineral resources are defined as natural concentrations of minerals or, in the case of aggregates, bodies of rock that are, or may become, of potential economic interest due to their inherent properties. The mineral will also be present in sufficient quantity to make it of intrinsic economic interest. Resources have, therefore, not only physical but also economic aspects. However, the presence of an otherwise economically viable resource is not in itself sufficient to ensure that mineral extraction will take place.

The economic potential of a resource can only be proved by a detailed evaluation programme, involving drilling and associated test work to prove that a deposit of sufficient quantity and quality is present. That part of a mineral resource, which has been fully evaluated and is deemed commercially viable to work, is called a mineral reserve. Reserves will need to meet not only the requirements of geological certainty and economic viability but also accessibility based on legal permission to extract the mineral[21].

Chart 5.1: World Lithium Resources (in million tons)



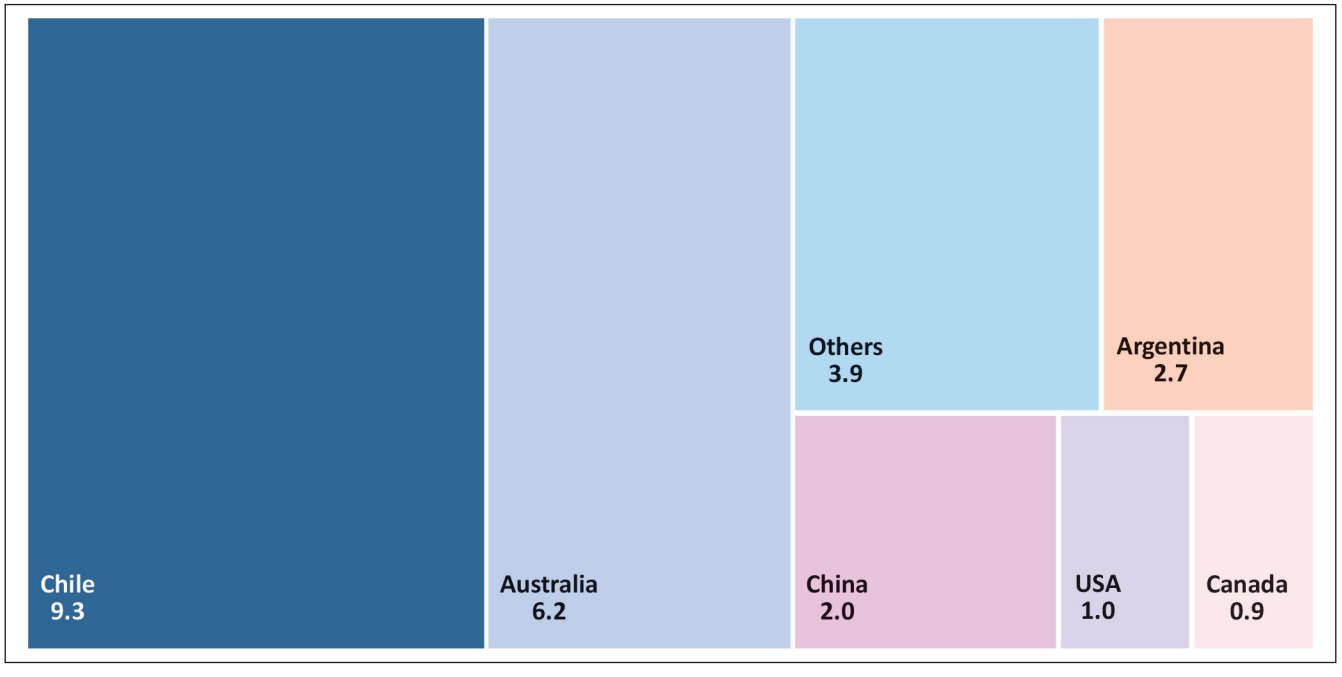
Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2023 and India Exim Bank Research

[20] USGS 2023, Commodity Summary: Lithium
[21] British Geological Survey

Lithium is extracted from lithium minerals found in igneous rocks composed of large crystals (spodumene) or in water with a high concentration of lithium carbonate (brine). Historically global lithium supply was dominated by hard-rock mineral sources. However, in the early 1980s, large-scale lithium brine operations commenced in South America. Today, the world's lithium production is split evenly between hard rock and brine.

The continental brine aquifers in the Andes Mountain ranges of South America located at a high altitude are the most abundant source of lithium-rich brine[22]. The high altitude promotes evaporation process due to lower atmospheric pressure. The Salars are concentrated in three countries, Argentina, Bolivia and Chile which are collectively referred to as the Lithium Triangle that accounts for roughly 53.1% of the global lithium resources[23]. Argentina has a number of salars with high lithium deposits including Salar de Muerto Hombre, Salar de Olaroz and Salar de Marianna. Bolivia's Salar de Uyuni is estimated to be the largest reserve base of lithium in the world. Bolivia's total resources represent 21.4% of the world's total lithium resources. Chile's Salar de Atacama is currently the largest source of lithium production from brine in the world. Lithium from brines is extracted in the form of lithium carbonate or lithium chloride through solar evaporation. Apart from continental brines, two other forms of brines exist from which lithium may be extracted which are geothermal brines and oilfield brines which are the waste product of oil extraction process. Apart from the Lithium Triangle, brine deposits are also located in United States, China and Canada.

Chart 5.2: World Lithium Reserves (in million tons)



Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2023 and India Exim Bank Research

Lithium occurs primarily in lithium pegmatites (in Australia, China, and Canada) or in the form of high-lithium brine deposits, which are mainly found in Lithium Triangle. Presently, only a select few lithium-containing minerals, including spodumene, lepidolite, petalite, amblygonite, and eucryptite, hold significant commercial

[22] Kavanagh et al. 2018, Global Lithium Sources – Industrial Use and Future in the Electric Vehicle Industry: A Review, Institute of Technology, Carlow, Ireland
[23] USGS 2023, Commodity Summary: Lithium

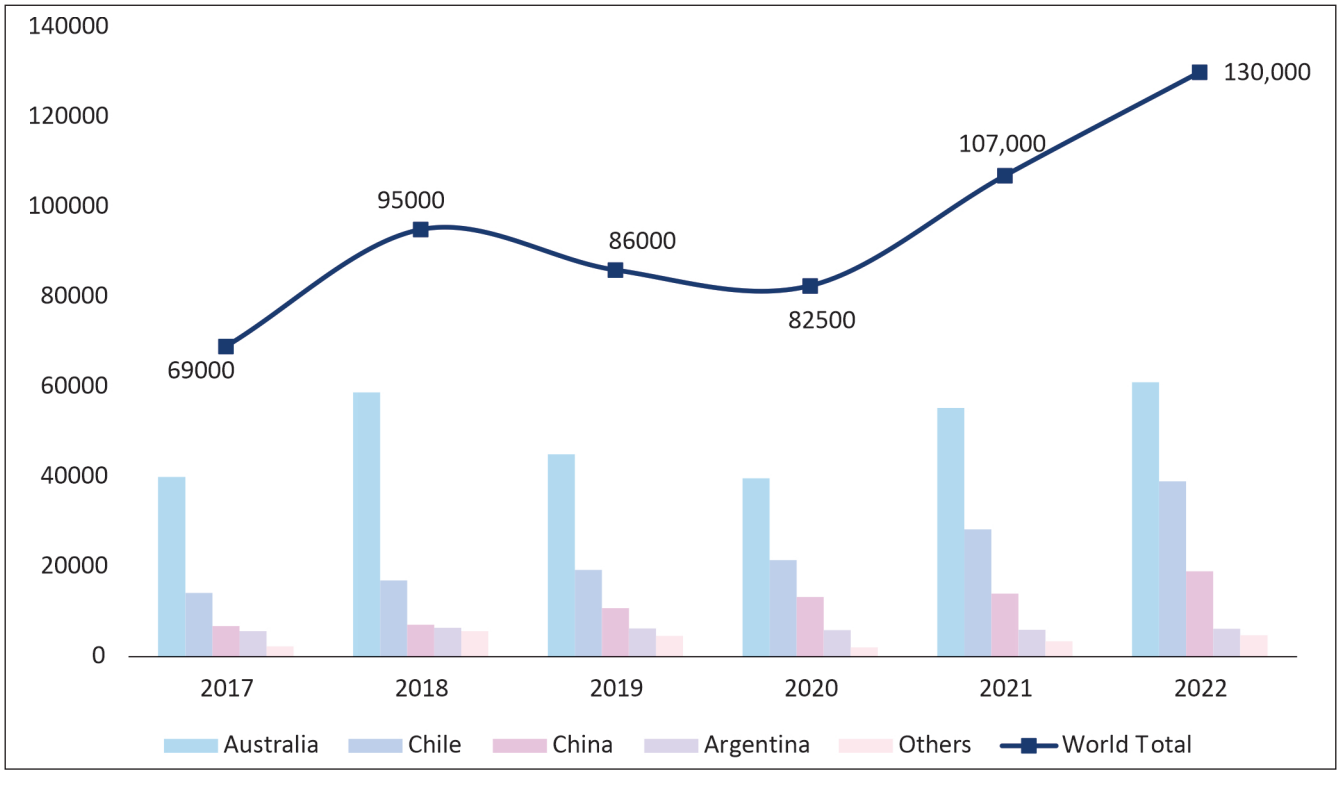
value out of the vast array of over 145 known lithium-containing minerals. Among these, Spodumene (a lithium rich granite pegamatite) is the most abundant lithium ore with the main producers located in Australia, Brazil, China, Portugal and Zimbabwe[24].

World lithium reserves have increased from 22 million tons in 2021 to 26 million tons in 2022. In terms of lithium reserves, Chile accounted for the largest share of global reserves of lithium at 35.8% followed by Australia (23.8%), Argentina (10.4%) and China (7.7%).

Production

The global production of lithium in 2022 was estimated at 130,000 tons increasing by 21.5% as compared to 2021. The global production of Lithium has grown by an average of 15.1% between 2017 to 2022. Six mineral operations in Australia, one mineral tailings operation in Brazil, two brine operations each in Argentina and Chile, and three mineral and two brine operations in China accounted for the majority of world lithium production. Additionally, smaller operations in Brazil, Canada, China, Portugal, the United States, and Zimbabwe also contributed to world lithium production[25]. Owing to the rapid increase in demand and prices of lithium in 2022, established lithium operations worldwide increased or were in the process of increasing production capacity. Chile is involved in processed lithium as well, though China dominates the production of processed and refined lithium products[26].

Chart 5.3: Global Annual Lithium Production (in tons)



Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2023 and India Exim Bank Research

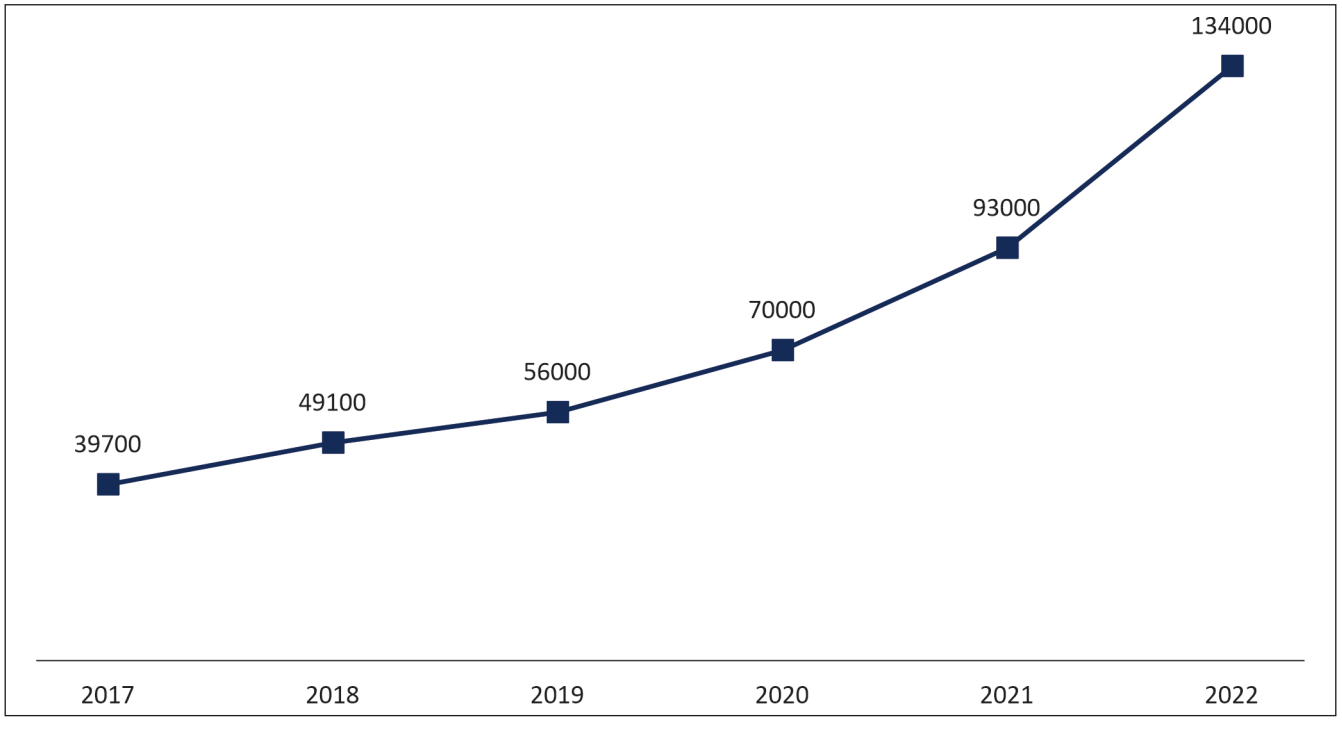
[24] Project economics of lithium mines in Quebec: A critical review
[25] USG, Lithium, January 2023.
[26] USITC, Office of Industries, 2020, Global Value Chains: Lithium-ion Batteries for Electric Vehicles

Talison Lithium, a three way joint venture between Tianqi Lithium Corporation (China) / IGO Limited (Australia) with 51% and Albemarle Corporation (US)- 49% operates the Greenbushes mine in Australia, with the production capacity of 50.9 thousand metric tons i.e., over half of global lithium production in 2021. Australia's Mineral Resoucres Ltd. (MRL) in joint venture with China's Ganfeng Lithium Co. operate the Mount Marion mine. In Chile, the largest producers of lithium are Chile's SQM and Albermarle. They operate two separate operations in Salar de Atacama. Chinese firms have displayed increasing interest in South America's lithium to bolster their supply. Tianqi acquired a 23.77% share in SQM in 2019 at US$ 4.1 billion[27]. In Argentina, Livent Corporation is the largest operator with a capacity of 20,000 tons per annum. Argentina's second operation is worked jointly by Australia's Allkem Ltd. (formerly Orocobre), Japan's Toyota Tsusho and Argentina's state-run JEMSE. China's Ganfeng is working in a joint venture with US-based Lithium Americas corp. and JEMSE in construction of another operation in Argentina[28]. China holds the dominant position in terms of production of refined lithium compounds. Tianqi and Ganfeng are the biggest firms with Tianqi being the largest lithium refiner in the world. While China was the 3rd largest producer of lithium in the world in 2021, it depends heavily on imports from Australia to meet domestic demand for processing and refining as well as production of batteries.

Consumption and Demand

In 2022, the global consumption of lithium was estimated to be 134,000 tons which represented a 44.1% increase over 2021. Lithium has many different applications ranging from batteries powering small electronic devices and power tools, through to electric vehicles and grid stabilisation/ storage facilities. Lithium is also used in ceramics, glassware and other industrial and medical applications.

Chart 5.4: World Annual Lithium Consumption (in tons)

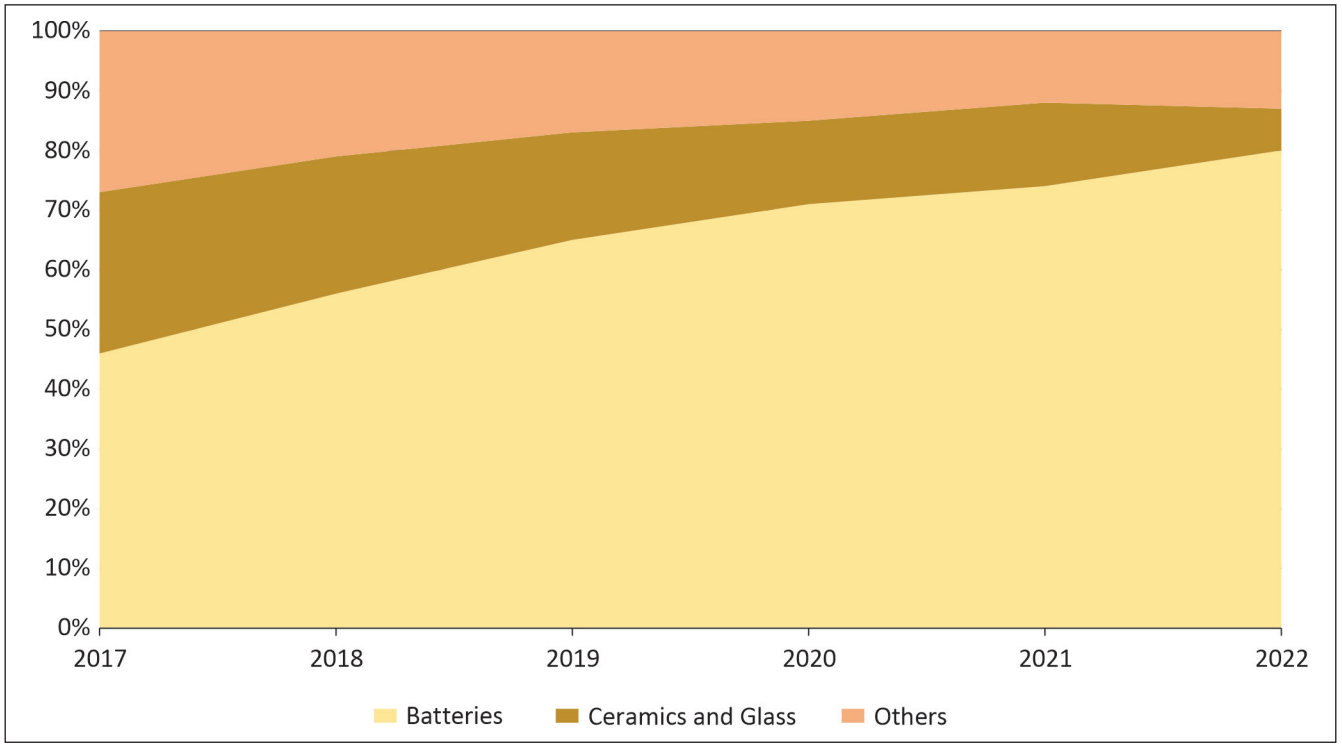


Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2023 and India Exim Bank Research

[27] USITC, Office of Industries, 2020, Global Value Chains: Lithium-ion Batteries for Electric Vehicles
[28] Secretariat of Minerals, Ministry of Productive Development, Argentina, 2021, Lithium in Argentina

A major proportion of lithium finds end-use in batteries with a share of 80%, followed by ceramics and glass (7%). Other sources of demand include use in lubricating greases (4%); continuous casting mold flux powders (2%); air treatment (1%); medical (1%) and other uses (5%). The share of lithium consumption for batteries has increased exponentially in the last decade as a result of expanding markets of electric vehicles and portable electronic devices that require rechargeable lithium batteries[29]. Lithium-based batteries are also finding increasing application in electric tools and grid storage as well. As shown in **Chart 5.5**, it is observed that Lithium usage has increasingly shifted to batteries increasing from 46% in 2017 to 80% in 2022, respectively.

Chart 5.5: Lithium Usage in Different Sources (as % of total demand)



Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2023 and India Exim Bank Research

Lithium-ion batteries (LIBs) have various advantages such as high energy density, low self-discharge rate, long life cycle, no memory effect, low maintenance, fast charging and lower weight (40 to 60% lower than lead-acid batteries)[30]. Lead-acid batteries have specific energies in the range of 35-40 Wh/kg (watt-hours per kilogram), lithium-ion batteries have a range of 90-260 Wh/kg which allows them to be packed into more compact battery packs[31].

According to the USG, Spot lithium carbonate prices in China (cost, insurance, and freight [c.i.f.]) increased from approximately US$ 35,000 per ton in January 2022 to about US$ 67,000 per ton in November 2022. For fixed contracts, the annual average U.S. lithium carbonate price was US$ 37,000 per ton in 2022, almost three times higher than that in 2021. Spot lithium hydroxide prices in China (free on board) increased from approximately US$ 35,300 per ton in January to about US$ 78,000 per ton in November 2022. Spot spodumene

[29] USGS 2022, Commodity Summary Lithium
[30] Kavanagh et al. 2018
[31] IEA 2021, The Role of Critical Minerals in Clean Energy Transitions

(6% lithium oxide) prices in China (c.i.f.) increased from approximately US$ 4,900 per ton in January 2022 to about US$ 5,800 per ton in November 2022.

Lithium demand has almost doubled since 2017 to 80 kilotonnes (kt) in 2021, of which demand for EV batteries accounts for 47%, up from 36% in 2020 and only 20% in 2017. Lithium is also used in the production of ceramics, glass and lubricants. Batteries are now the dominant driver of demand for lithium and therefore set the price. The availability of lithium supply is of particular concern because it is irreplaceable for Li-ion batteries and there are no commercial alternative battery chemistries available at scale today that meet the performance of Li-ion batteries.

High battery demand has spurred significant increases in demand for key metals used in their production. Between the start of 2021 and May 2022 lithium prices increased more than sevenfold and cobalt prices more than doubled. Nickel prices almost doubled over the same period reaching levels not seen for almost a decade. The unprecedented battery metal price rises have been caused by a combination of surging battery demand, increasing pressure on supply chains and concerns around tightening supply. The supply constraints have been driven by three trends: first, production challenges caused by the pandemic; second, concerns around Class 1 nickel supply from Russia; and third, structural underinvestment in new supply capacity during the three years preceding 2021 when metal prices were low. Some producers delayed or even curtailed planned projects and expansions due to low lithium prices.

Global Energy Transition, Electric Vehicles and Demand for Lithium

The global energy systems are undergoing a major energy transition as countries across the world are implementing measures to substitute and eliminate traditional sources of energy derived from hydrocarbons towards development of clean and sustainable sources. This has led to rapid deployment of electric vehicles, solar panels, wind turbines etc. Globally, energy demand fell in 2020 for all traditional sources including oil, coal, gas and nuclear energy with only modern renewables registering a growth.

Sales of electric vehicles (EVs) doubled in 2021 from the previous year stood at 6.6 million. In 2021, almost 10% of global car sales were electric 4 times the market share in 2019. However, if global climate goals are to be met, their share needs to rise to 40% by 2030. China and Europe are the leading markets with Battery Electric Vehicles (BEV's) and Plug-in Electric Vehicles (PHEVs) being the leading segments. The global consumer spending on electric vehicles doubled in 2021 over 2020 to US$ 250 billion with government spending in the form of subsidies and tax reductions reaching US$ 30 billion[32].

Policy support from governments has been very instrumental in creating demand for EV and is expected to continue playing a crucial role. In Europe, government support has played a much larger role in terms of subsidy/rebate per vehicle. Many major car markets now offer some forms of subsidy or tax rebate for the purchase of electric cars in addition to programs for development of charging infrastructure[33].

The directives related to stricter regulations and emission targets as well as incentives provided by national and local governments play a key role in signaling a shift in investment to secure electric vehicle supply chains and for OEM's to transform their product offerings to include a larger number of zero-emission vehicles. Chinese automakers have announced pledges for electrification ranging from 50% to 85% by 2030 or 2035. OEM's in Europe and US have also announced ambitious targets for roll-out of electric fleets.

[32] IEA 2022, Global EV Outlook
[33] IEA 2022, Global EV Outlook

Compared to 2020, automotive LIB demand more than doubled in 2021 to 340 gigawatt-hours (GWh), driven primarily by electric passenger cars. Demand for other road vehicles including medium and heavy-duty vehicles and two/three wheelers also increased 65% in 2021. Currently, there is sufficient battery factory capacity for the total demand of EVs, consumer electronics and stationary storage batteries. In 2021, the global average capacity utilization rate for battery factories was 43%, though this has marked a significant increase from 33% in 2020. The average battery capacity of BEVs in 2021 was 55 kWh. China remains the biggest market for batteries, with automotive battery demand of 200 GWh in 2021. Growth was also impressive in the United States where demand more than doubled in 2021, albeit from a lower base. Europe's demand growth was slightly lower than last year, yet it still increased more than 70%.

According to the International Energy Agency, the Announced Pledges Scenario (APS), introduced in 2021, illustrates the extent to which announced ambitions and targets can deliver the emissions reductions needed to achieve net zero emissions by 2050. It includes all recent major national announcements as of the end of August 2023, both 2030 targets and longer-term net zero or carbon neutrality pledges, regardless of whether these announcements have been anchored in legislation or in updated Nationally Determined Contributions.

Under the Announced Pledges Scenario, demand for EV batteries will jump to over 3500 GWh by 2030 thereby requiring large investments in all stages of the battery supply chain, particularly in mining which is characterized by long lead times. While the projected mineral supplies are in line with meeting the demand for EV batteries under Stated Policies Scenario, minerals such as lithium will still face the possibility of wide demand-supply gaps. Under APS, demand for lithium is expected to grow more than 5-fold to 500 kilo tons by 2030[34].

Prices for batteries have fallen by 86% over the last decade due to economies of scale and continuous innovation throughout the supply chain. Despite the recent commodity price surge, battery prices declined further in 2021, with the Bloomberg New Energy Finance annual battery price survey recording a 6% decrease from 2020[35]. Batteries typically accounts for 30% to 40% of the value of an electric vehicle, and the targets set by countries to achieve net zero emissions will therefore lead to increased focus on the security of supply of the critical minerals and metals needed to manufacture them.

Battery Energy Storage Systems (BESS)

In 2020, the global battery storage capacity connected to electricity networks stood at 17 GW. LIBs continued to remain dominant, accounting for 93% of new installed capacity in 2020[36]. Current technologies make battery storage systems are more suited for short-duration storage, designed for charge and discharge in a span of hours or days[37]. Investment in battery storage increased to US$ 5.5 billion in 2020 while spending on grid batteries increased by 60%. Several policies have been announced to boost growth in energy storage deployment. China plans to install over 30 GW of energy storage by 2025, marking an almost 10-fold increase over its 2020 installed capacity. In the United States, the Better Energy Storage Technology Act authorized over US$ 1 billion over 5 years to support research and commercialization of a range of storage technologies. In 2021, the government pledged to achieve a carbon-free electricity sector by 2035. Scaling up energy storage systems becomes critical given the large deviations experienced by wind and solar electricity generation which are taking center-stage given the global push for green energy.

[34] IEA 2022, Global Supply Chains of EV Batteries
[35] World Energy Outlook 2022, International Energy Agency
[36] Energy Storage – Analysis - IEA
[37] IEA 2021, The Role of Critical Minerals in Clean Energy Transitions

If Paris Agreement goals are to be met, i.e., under IEA's Net Zero Scenario, the global installation of utility-scale battery storage will require an almost 25-fold increase from 5 GW in 2020 to 120 GW by 2030, with the largest markets for deployment being India, the United States and China. To fulfill the Net Zero targets, the total installed battery storage capacity needs to rise to 585 GW by 2030 or nearly 35-fold[38].

Within this new paradigm, lithium has assumed a critical role for electric vehicles and energy storage applications. EV batteries are the main driver for lithium demand. The share of EV batteries in total lithium demand has increased to 47% in 2021 from just 20% in 2017. The International Energy Agency (IEA) forecasts demand for lithium to increase to 13 to 42 times of present amount by 2040 relative to 2020 levels. IEA estimates that almost 90% of this demand will be for applications in clean energy technologies by 2040[39].

International Trade of Lithium

Economically feasible raw material resources of lithium that can support global value chains are concentrated in a few countries such as Australia and to a much greater extent in the Lithium Triangle.

In the context of international trade, three main forms of lithium can be distinguished and defined at the global HS 6-digit subheading level. These are[40]:

- Unprocessed Lithium – HS 253090
- Processed Lithium – HS 283691, HS 282520
- Refined Lithium Products – HS 282739, HS 282690, 280519

Trade In Unprocessed Lithium

Unprocessed lithium refers to ores and concentrates of lithium. Trade in this product is characterized by the strong linkage between Australia and China with Australia being the largest exporter while China was the largest importer in 2021 **(Table 5.1)**.

Table 5.1: Major Global Exporters of Unprocessed Lithium (HS 253090)

Exporters	2017	2018	2019	2020	2021	Share in 2021 (%)
World	2130.5	2294.9	2050.9	1657.4	2609.1	100.0
Australia	997.4	1174.0	1012.3	654.4	1284.9	49.2
China	124.3	145.5	125.4	115.2	146.3	5.6
Russia	78.5	62.4	66.2	91.8	116.5	4.5
Spain	93.3	106.4	92.1	86.7	114.3	4.4
Netherlands	58.4	76.1	84.4	90.8	101.9	3.9
USA	171.6	128.8	96.7	82.4	93.2	3.6
Germany	85.1	91.1	80.6	78.1	92.4	3.5
Brazil	3.4	4.9	16.1	21.0	68.1	2.6
Belgium	61.9	70.4	68.3	55.5	59.9	2.3
Italy	53.2	48.4	47.6	46.2	56.3	2.2

Source: ITC Trademap and India Exim Bank Research

[38] Energy Storage – Analysis - IEA
[39] IEA 2021, The Role of Critical Minerals in Clean Energy Transitions
[40] USITC, Office of Industries, 2020, Global Value Chains: Lithium-ion Batteries for Electric Vehicles

The unprocessed lithium exported from Australia to China is processed and refined and subsequently used in the manufacture of batteries designed for various applications.

Table 5.2: Major Global Importers of Unprocessed Lithium (HS 253090)

Importers	2017	2018	2019	2020	2021	Share in 2021 (%)
World	2026.1	2699.5	2408.5	1885.3	2968.1	100.0
China	972.9	1471.6	1251.8	853.4	1724.1	58.1
USA	68.8	87.5	101.6	79.3	100.9	3.4
Japan	71.4	83.6	76.5	71.1	99.0	3.3
Germany	78.4	89.9	96.2	86.4	98.2	3.3
France	66.9	75.4	67.7	71.6	73.1	2.5
Belgium	56.6	58.2	71.9	62.6	67.4	2.3
Türkiye	39.1	47.8	40.1	47.6	67.1	2.3
Italy	47.9	57.4	59.3	42.5	57.9	2.0
Republic of Korea	56.3	73.8	58.4	58.4	56.0	1.9
Netherlands	43.0	58.5	53.5	54.1	54.7	1.8

Source: ITC Trademap and India Exim Bank Research

Trade In Processed Lithium

The unprocessed lithium is treated and concentrated into processed lithium chemicals which refer to intermediary forms of lithium like lithium carbonate and lithium hydroxide. These two compounds are used in creating cathode materials or for further processing to create battery electrolyte. Brine concentrates are a cheaper source of lithium carbonate while, lithium hydroxide is obtained more cheaply from mineral ores.

As shown in **Table 5.3**, Chile is the largest supplier of lithium carbonates (HS-283691) with total exports of US$ 882.9 million in 2021 accounting for 72.8% of global exports of lithium carbonate. Bolivia was the 10th largest exporter in 2021 accounting for a share of 0.8%.

Table 5.3: Global Exporters of Lithium Carbonate (HS 283691)

Exporters	2017	2018	2019	2020	2021	Share in 2021 (%)
World	1117.1	1343.0	1244.3	941.1	1212.6	100.0
Chile	682.5	942.5	833.6	680.4	882.9	72.8
China	32.0	164.9	159.5	59.6	99.4	8.2
Netherlands	2.8	5.0	62.1	36.7	54.1	4.5
Republic of Korea	30.3	19.0	20.3	19.6	46.3	3.8
Belgium	84.0	104.2	84.3	32.4	31.1	2.6
Germany	33.8	43.7	37.8	20.0	21.8	1.8
USA	23.1	23.0	14.0	13.4	18.4	1.5
UK	10.7	14.8	7.6	4.4	16.3	1.3
France	4.1	8.7	8.6	6.6	10.6	0.9
Bolivia	0.5	0.6	0.0	0.0	9.9	0.8

Source: ITC Trademap and India Exim Bank Research

China (36.8%), South Korea (25.2%) and Japan (13.6%) are the largest importers of lithium carbonates. India was the 10th largest importer of lithium carbonate (US$ 8.8 million) accounting for a share of 0.6% in 2021.

Table 5.4: Global Importers of Lithium Carbonate (HS 283691)

Importers	2017	2018	2019	2020	2021	Share in 2021 (%)
World	1198.0	1708.2	1546.1	1117.3	1523.5	100.0
China	362.2	361.5	240.3	261.0	562.1	36.9
Republic of Korea	247.4	458.5	483.5	313.5	384.4	25.2
Japan	195.1	317.1	312.5	191.8	207.0	13.6
USA	80.6	128.5	104.5	76.9	80.6	5.3
Germany	44.6	61.0	67.7	53.9	56.2	3.7
Russia	47.5	58.6	61.9	45.4	53.5	3.5
Netherlands	4.5	4.8	76.7	40.0	48.2	3.2
Belgium	91.2	149.6	87.4	59.7	29.4	1.9
UK	19.0	25.8	12.7	8.2	17.4	1.1
France	11.6	31.8	20.9	11.0	15.2	1.0
Italy	12.1	15.3	8.2	6.1	10.6	0.7
India	12.0	14.7	12.7	8.1	8.8	0.6

Source: ITC Trademap and India Exim Bank Research

China is the largest exporter of lithium oxide and hydroxide (HS-282520), with exports of US$ 763.9 million in 2021, representing a global share of 68.6% in total exports. The US and Chile are next with share in total exports of 8.8% and 8.6% respectively followed by Russia with a share of 7.1%.

The government of Chile has made efforts towards attracting investment in downstream industries using lithium as input by offering lower costs supply of lithium with a view to capture a larger portion of LIB value chain.

Table 5.5: Major Global Exporters of Lithium Oxide and Hydroxide (HS 282520)

Exporters	2017	2018	2019	2020	2021	Share in 2021 (%)
World	591.2	801.4	1033.9	792.9	1113.3	100.0
China	237.9	398.0	623.4	544.4	763.9	68.6
USA	112.0	101.8	104.4	65.9	97.5	8.8
Chile	99.0	94.0	120.6	75.3	95.4	8.6
Russia	62.8	67.3	78.3	68.0	79.4	7.1
Netherlands	14.3	17.7	32.0	20.4	32.6	2.9
Belgium	42.5	38.0	23.7	4.8	8.6	0.8
Republic of Korea	0.2	0.3	0.8	0.8	7.6	0.7
UK	3.9	4.8	5.2	2.6	6.3	0.6
UAE	2.1	1.6	2.5	1.6	5.5	0.5
France	2.1	2.5	2.4	2.0	5.1	0.5
India	2.1	2.6	1.9	1.2	4.1	0.4

Source: ITC Trademap and India Exim Bank Research

South Korea and Japan are the top importers with imports of US$ 667.0 million and US$ 388.7 million respectively, in 2021. The two together accounted for 83.6% of global lithium oxide and hydroxide imports in the world. India was the 4th largest importer of lithium oxide and hydroxide of amount US$ 24.1 million in 2021 accounting for a share of 1.9%.

Table 5.6: Major Global Importers of Lithium Oxide and Hydroxide (HS 282520)

Importers	2017	2018	2019	2020	2021	Share in 2021 (%)
World	602.3	745.8	1078.2	958.5	1263.8	100.0
Republic of Korea	132.5	229.3	385.5	439.8	667.0	52.8
Japan	218.6	280.0	485.7	392.0	388.7	30.8
China	15.4	20.5	6.3	3.2	33.4	2.6
India	35.9	34.9	23.2	12.5	24.1	1.9
USA	28.6	18.5	17.7	15.0	19.2	1.5
France	10.9	13.6	13.1	8.6	12.0	1.0
Canada	8.0	11.1	12.0	9.6	11.8	0.9
UAE	5.0	7.4	6.8	4.2	10.3	0.8
Netherlands	5.2	3.1	18.0	11.2	9.4	0.7
UK	7.7	6.9	6.8	4.2	7.7	0.6

Source: ITC Trademap and India Exim Bank Research

Trade In Refined Lithium Compounds

Processed lithium chemical may require further treatment to yield specific refined lithium compounds which are ready for end-use. These include pure lithium metal, alloys or electrolyte solutions containing lithium. Lithium alloys are used in making cathode materials for LIBs and lithium chloride is used in making electrolyte solutions which are the medium through which ion exchange occurs between the cathode and anode. Lithium hexafluorophosphate (LPF) (HS-282690) is the most commonly used lithium concentrate used in LIB elecrolytes[41].

Trade volumes in refined lithium compounds in the form of fluorine salts (HS-282690), chlorides (HS-282739) and as pure metal (HS-280519) is lower than those for unprocessed and processed lithium. This indicates that countries importing large quantities of unprocessed and processed lithium compounds refine these further for end-use. Thus, presumably, China, Japan and South Korea which are the largest importers are producing refined lithium as an input for their battery manufacturing industries. China, European Union (EU-28), South Korea, United States and Japan are the largest exporters and importers of the product, indicating most of the final value addition in manufacture of LIBs is concentrated in these regions.

China is the largest processor and refiner of lithium compounds. Private Chinese firms have in recent years increased production of lithium materials and batteries in China and also acquired significant stakes in lithium mining operations across various countries. This is a result of Chinese government's focus on subsidizing OEMs for fleet electrification and encouraging consumers to purchase electric vehicles which has allowed private firms to pursue aggressive expansion in all stages of lithium and LIB value chains. The Made in

[41] USITC, Office of Industries, 2020, Global Value Chains: Lithium-ion batteries for Electric Vehicles

China 2025 program announced in 2015 has the goal of having two Chinese firms among the top-ten largest new-energy vehicle manufacturers in the world.

This is also reflected by the data of major exporters of HS 282739, HS 282690 and HS 280519 where China is the largest exporter accounting for a global share of 15%, 49.2% and 45.4%, respectively. India accounted for 8.3% of global exports of lithium chloride.

Table 5.7: Major Global Exporters of Chlorides (excluding ammonium, calcium, magnesium, aluminium, nickel and mercury chloride) HS 282739

Exporters	201	2018	2019	2020	2021	Share in 2021 (%)
World	460.4	570.9	537.4	466.1	691.8	100.0
China	84.1	114.9	117.9	76.5	103.8	15.0
Germany	70.8	77.2	76.5	78.0	96.8	14.0
USA	49.4	53.2	56.3	68.5	94.5	13.7
France	4.0	7.0	10.8	10.8	74.2	10.7
India	26.9	30.8	30.7	33.7	57.7	8.3
Belgium	26.0	74.2	52.9	35.1	49.2	7.1
UK	21.3	45.4	34.1	28.0	40.2	5.8
Republic of Korea	18.7	19.0	15.8	21.1	33.0	4.8
Spain	19.0	18.0	17.1	19.7	21.5	3.1
Japan	17.7	18.6	18.4	17.2	20.7	3.0

Source: ITC Trademap and India Exim Bank Research

USA, countries of European Union, Republic of Korea were among the major importers of lithium chloride in 2021. India accounted for 5.6% of global imports during the same period.

Table 5.8: Major Global Importers of Chlorides (excluding ammonium, calcium, magnesium, aluminium, nickel and mercury chloride) HS 282739

Importers	2017	2018	2019	2020	2021	Share in 2021 (%)
World	619.6	768.2	704.7	637.8	794.3	100.0
USA	60.7	68.7	65.3	57.3	83.6	10.5
Germany	66.3	85.1	71.3	61.6	72.4	9.1
Republic of Korea	30.3	33.5	40.4	42.1	60.9	7.7
France	47.5	71.6	62.6	43.5	57.1	7.2
Japan	29.3	42.0	53.9	40.3	46.0	5.8
India	30.3	41.1	40.4	38.3	44.8	5.6
Italy	25.2	29.1	25.9	23.7	33.6	4.2
Netherlands	23.4	27.3	24.2	20.9	32.7	4.1
Russia	18.9	25.9	26.9	23.2	30.7	3.9
China	40.4	41.2	31.0	16.1	25.9	3.3

Source: ITC Trademap and India Exim Bank Research

Table 5.9: Major Exporters of "Fluorosilicates, fluoroaluminates and other complex fluorine salts (excluding sodium hexafluoroaluminate" "synthetic cryolite" and "inorganic or organic compounds of mercury)" – HS 282690

Exporters	2017	2018	2019	2020	2021	Share in 2021 (%)
World	290.6	339.2	337.6	370.7	667.2	100.0
China	82.3	133.2	137.4	145.5	328.2	49.2
Republic of Korea	35.7	30.9	21.1	33.3	110.7	16.6
Thailand	19.2	23.3	20.0	43.3	57.9	8.7
Japan	42.5	40.6	55.3	36.2	52.5	7.9
Germany	51.2	50.7	45.3	36.6	38.1	5.7
USA	7.2	8.0	18.7	43.2	20.3	3.0
Hong Kong	8.1	7.4	3.3	2.6	17.0	2.5
Belgium	7.8	8.7	7.6	8.6	11.2	1.7
Netherlands	8.4	7.5	5.3	5.2	9.4	1.4
Spain	5.3	6.1	6.7	5.9	6.9	1.0

Source: ITC Trademap and India Exim Bank Research

Table 5.10: Major Importers of "Fluorosilicates, fluoroaluminates and other complex fluorine salts (excluding sodium hexafluoroaluminate" "synthetic cryolite" and "inorganic or organic compounds of mercury)" – HS 282690

Importers	2017	2018	2019	2020	2021	Share in 2021 (%)
World	398.3	490.2	425.0	457.4	715.3	100.0
Japan	130.9	140.2	117.9	140.8	151.8	21.2
Republic of Korea	16.6	26.9	38.3	42.0	137.9	19.3
China	62.2	40.2	25.9	28.7	93.9	13.1
USA	67.2	97.4	97.3	68.7	93.0	13.0
Mozambique	0.0	61.0	20.5	65.6	37.2	5.2
UK	1.8	4.9	15.2	18.9	32.7	4.6
Hong Kong	11.8	11.0	4.6	3.5	17.6	2.5
Netherlands	12.7	13.9	14.0	9.9	16.3	2.3
Hungary	0.7	1.2	0.9	0.4	13.6	1.9
Czech Republic	0.2	0.2	0.1	4.4	12.4	1.7

Source: ITC Trademap and India Exim Bank Research

Table 5.11: Major Global Exporters of Alkali or alkaline-earth metals (excluding sodium and calcium) HS 280519

Exporters	2017	2018	2019	2020	2021	Share in 2021 (%)
World	148.0	195.5	177.3	139.2	149.2	100.0
China	52.7	78.7	60.5	41.1	67.8	45.4
USA	34.0	40.9	32.7	31.1	29.1	19.5
Russia	13.2	20.4	23.4	21.5	17.7	11.8
Germany	18.1	25.0	26.2	23.8	16.6	11.1
France	6.5	7.3	7.1	7.0	7.1	4.7
Philippines	0.0	3.2	10.0	8.7	3.6	2.4
Netherlands	0.5	0.9	1.2	1.5	1.6	1.1
India	0.3	0.2	1.8	0.5	1.0	0.6
Thailand	5.5	2.0	1.2	1.0	0.8	0.5
Saudi Arabia	0.0	0.1	0.0	0.0	0.6	0.4

Source: ITC Trademap and India Exim Bank Research

Table 5.12: Major Global Importers of Alkali or alkaline-earth metals (excluding sodium and calcium) HS 280519

Importers	2017	2018	2019	2020	2021	Share in 2021 (%)
World	191.5	248.5	314.5	315.4	295.1	100.0
Germany	29.5	31.1	129.6	172.5	122.8	41.6
UK	12.0	19.8	24.7	16.6	17.7	6.0
Singapore	13.0	21.3	17.3	14.4	16.7	5.7
India	10.8	13.2	11.9	9.2	14.4	4.9
Indonesia	17.8	20.1	15.5	13.0	13.4	4.5
USA	15.9	28.0	19.6	14.5	13.0	4.4
France	9.2	12.9	11.0	8.2	12.6	4.3
Taiwan	6.9	12.5	14.2	12.0	12.0	4.1
Japan	15.8	15.8	12.2	9.9	10.6	3.6
Switzerland	9.0	9.1	10.6	8.7	8.6	2.9

Source: ITC Trademap and India Exim Bank Research

Chapter

Strategies for Securing India's Lithium Needs

As per the updated Nationally Determined Contributions (NDC), India has committed to achieve about 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. So far, a total of 167.75 GW Renewable Energy capacity has been installed as on December 31, 2022, in India. India stands 4th globally in Renewable Energy Installed Capacity, 4th in Wind Power capacity & 4th in Solar Power capacity. The total solar power capacity in the country has increased from 2.63 GW in March 2014 to 63.30 GW in December 2022, increasing by more than 20 times[42].

India has set an ambitious target of attaining a capacity 500 GW of non-fossil fuels-based energy and reduce projected CO_2 emissions by 1 billion tons by 2030. Massive deployment of grid storage and sweeping uptake of electric vehicles will be essential for achieving these goals. In turn, the requirement for batteries to support this transition will be enormous. India currently has a negligible presence in the global supply chain for Advanced Cell Chemistry (ACC) technologies. However, India plans to fulfill its future requirements through the development of its domestic battery manufacturing ecosystem in line with its ambition of self-reliance in this sector. However, presently raw materials and technology are the major barriers to large scale manufacturing of Lithium-Ion batteries in India.

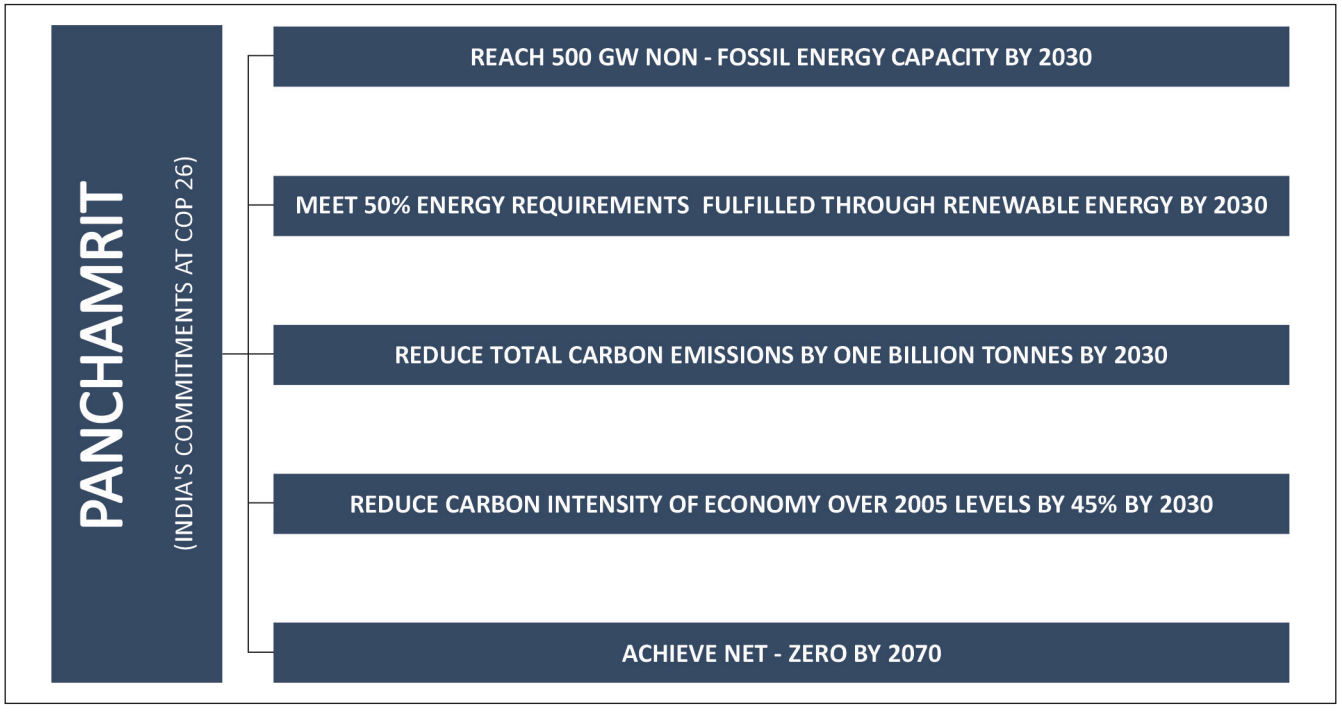
India faces significant challenges in sourcing raw materials, which is a major barrier to fully participating in the battery manufacturing value chain. The country has limited reserves of essential ingredients like lithium, cobalt, and battery-grade graphite, relying heavily on imports from countries like China. To overcome this, India needs to develop advanced metal processing and refining infrastructure to ensure the correct concentration of raw materials. However, global supplies of minerals for battery chemistries are not currently constrained, with lithium reserves alone expected to meet global demand. India can establish external supply chains by signing Memorandums of Understanding (MoUs) with countries like Australia, Chile, and the Democratic Republic of the Congo to secure a stable supply of processed raw materials, particularly for nickel and cobalt. India has already signed an MoU with Bolivia to facilitate the supply of lithium carbonate and explore joint ventures in lithium battery manufacturing. Additionally, investing in battery recycling can help India maintain a strong access to critical raw materials in the long term[43].

Developing a localised advanced cell supply-chain ecosystem will help India create a competitive advantage in the mobility, grid energy storage, and consumer electronics spaces. This domestic supply chain will insulate

[42] Annual Report 2022-23, Ministry of New and Renewable Energy, Government of India.
[43] Need for Advanced Chemistry Cell Energy Storage in India, Niti Ayog, September 2022.

itself from any supply shocks that could put the entire battery ecosystem at risk. The development of a domestic battery manufacturing ecosystem is crucial to achieving India's ambitious goal of electric mobilisation and 500 gigawatts (GW) of installed non-fossil fuel energy by 2030.

Exhibit 6.1: India's Commitments at COP26



Source: Ministry of Environment, Forest and Climate Change, Government of India, Press Release, February 3, 2022.

National Level Policies for Electric Vehicles and Battery Storage

Governments at both the national and state level have launched a slew of measures to create an enabling environment for an expedited roll out and adoption of EVs. These initiatives have focused on different aspects like reduction in barriers for EV adoption, promotion of EV growth like purchase incentives like waivers of road tax, registration fees etc. The government has also launched several programs for the promotion of investment in capacity creation for EV and LIB manufacturing.

The Government launched the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) Scheme since 2015 on pan India basis to promote the use of electric vehicles in the country. Presently, Phase-II of FAME India Scheme is being implemented for a period of 5 years with effect from April 1, 2019, with a total budgetary support of Rs. 10,000 crores[44].

Production-Linked Incentives (PLI)

The Production-Linked Incentive (PLI) Schemes are being implemented since 2020 across various sectors with the objective of creating 'national manufacturing champions' as well as for generating employment opportunities.

[44] PIB Press Release, Ministry of Heavy Industries, GOI, December 2021.

Key PLI schemes which are expected to drive the demand for lithium in India are:

- Automobiles and Auto Components
- Electronics/ Technology Products
- High-Efficiency Solar PV Modules
- Advanced Chemistry Cell (ACC) Battery

The PLI Scheme for automobiles and auto components scheme has two subdivisions, first the Champion OEM Incentive Scheme and second, the Component Champion Incentive Scheme. The Champion OEM scheme is a 'sales value linked' scheme applicable on Battery Electric vehicles and Hydrogen Fuel Cell Vehicles spanning all segments. The Component Champion scheme is a 'sales value linked' scheme applicable on Advanced Automotive Technology Incentives. The outlay automotive PLI scheme was ₹25,938 crores and it has successfully attracted proposed investments of ₹74,850 crores (₹45,016 crores for Champion OEMs scheme and ₹29,834 crores for Component Champions scheme) against the target of ₹42,500 crores over a period of 5 years. Firms from not only India, but also countries like Japan, Germany, South Korea, the United States, UK, Italy, Belgium and Netherlands have been selected for the scheme[45].

The Electronics/Technology products PLI has an incentive outlay of ₹40,951 crores and aims to help India become a global center for Electronics System Design and Manufacturing (ESDM) and achieve the broader goal of achieving ₹30 lakh crores turnover in the ESDM value chain by 2025 set under National Policy on Electronics (NPE) 2019 including production of 1 billion mobile phones valued at over ₹14 lakh crores. The PLI scheme seeks to facilitate production of over ₹10.5 lakh crores by 2025. A second round of the PLI scheme for large scale electronics manufacturing targeting specified electronics components has also been approved[46].

The PLI scheme for high efficiency solar PV modules has a financial outlay of ₹4500 crores over 5 years. The aim is to promote manufacturing of high efficiency solar PV modules in India and reducing import dependence by providing incentives of sales of such solar PV modules. The scheme has received an additional outlay of ₹19,500 crores in the Union Budget 2022-23[47].

The Production Linked Incentive Scheme for the 'National Program on Advanced Chemistry Cell (ACC) Battery Storage' has an outlay of ₹18,100 crores with the goal of achieving a manufacturing capacity of 50 GWh of ACC battery storage. Private companies have been investing in setting up battery pack capacities however these are too small and hence all demand for ACC is currently being met through imports. Under the scheme, an increasing amount of incentive will be provided with increasing specific energy density and cycles and the proportion of domestic value addition[48]. Storage manufacturers would need to commit to setting up an ACC facility of a minimum capacity of 5 GWh (which will qualify the facility to be classified as a gigafactory) and ensure minimum domestic value addition of 60% within 5 years. The government expects the scheme to accelerate EV deployment in the country through reduced costs which will help save ₹20,00 crores in direct battery import bills as well as an estimated ₹ 2 - ₹ 2.5 lakh crore in oil import bills. A total of 10 bids with capacity of approximately 130 GWh were received under the scheme out of which the announced capacity of 50 GWh has been awarded with bids of 58 GWh being waitlisted[49].

[45] Ministry of Heavy Industries, Government of India
[46] Ministry of Electronics & Information Technology, Government of India
[47] Indian Renewable Energy Development Agency (IREDA), Ministry of New and Renewable Energy, Government of India
[48] NITI Aayog, RMI India, Need for Advanced Chemistry Cell Storage in India, 2022
[49] Ministry of Heavy Industries, Government of India

This PLI scheme for Advanced Chemistry Cell (ACC) (₹18,100 crore) along with the already launched PLI Scheme for automotive sector (₹25,938 crore) and Faster Adaption of Manufacturing of Electric Vehicles (FAME) (₹10,000 crore) will enable India to leapfrog from traditional fossil fuel-based automobile transportation system to environmentally cleaner, sustainable, advanced and more efficient Electric Vehicles (EV) based system.

Drones and Defence Requirements

The Drone Rules, 2021 published by the Ministry of Civil Aviation have brought in sweeping liberalization in drone applications. The new rules have reduced regulatory and licensing burden through abolishment of various approvals that were earlier required, trimmed the filing and fees requirements. The new policy has relaxed approvals and certificate requirements related to conformance, manufacturing, airworthiness, maintenance, import clearance etc. The 'Digital Sky' platform has been developed as a user-friendly single-window system which will also host an airspace map displaying green, yellow and red zones where green zones signify no permissions required for use of drones. Under the new policy, drone corridors will be developed for cargo deliveries and a drone promotion council is to be set up to facilitate a growth-oriented regulatory regime.

Drones are finding innovative applications in agriculture, mining, infrastructure, surveillance, emergency response, transportation, geospatial mapping, defense and law enforcement. They have been used in surveillance systems for railway security, for mapping inhabited areas under 'SVAMITVA' scheme, for delivery of COVID-19 vaccines in remote and inaccessible areas, for surveillance of hotspots and containment zones. India's Defense Research and Development Organization, under its UAV program has developed a fleet of vehicles like Lakshya, Nishant and Rustom which have applications in areas such as reconnaissance, target acquisition, intelligence-gathering, artillery fire correction, damage assessment and combat missions as well.

The market for drones in India was valued at US$ 830 million in FY2020 and is expected to grow at a CAGR of over 14% between 2021 and 2026. Ample areas of opportunities in the commercial (e-commerce, construction, media) as well as the defense (sensors, radars, jammers, laser-DEW systems) space exist[50].

In addition to drones and their aerial defense applications, LIBs are extremely attractive for naval forces. Currently, submarines rely on lead-acid batteries to traverse silently underwater. These lead-acid batteries are charged by a diesel engine, which needs oxygen and hence the submarine needs to resurface. With LIB's the submarines can stay underwater for much longer as compared to lead-acid batteries. In military applications, LIBs are currently being used portable manual applications like tactical radios, thermal imagers and portable computing. There usage is expected to expand to more heavy-duty applications like military vehicles, boats, shelter applications, aircrafts and missiles[51].

Mapping the Demand for Lithium-Ion Batteries in India

Given India's focus on transitioning to new and renewable sources of energy with a view to achieve sustainability, tackle environmental damage, reduce oil import dependence and be energy secure and possibly capture significant parts of value chains in rapidly growing industries like electric vehicles, ACC batteries,

[50] International Trade Administration, US Department of Commerce

[51] Blagoeva, D et al., Materials dependencies for dual-use technologies relevant to Europe's defence sector, EUR 29850 EN, Publications Office of the European Union, Luxembourg, 2019

solar PVs and consumer electronics, the demand for lithium-ion batteries in the country is expected to be enormous.

The plethora of national and state-level initiatives are fostering an ecosystem which is expected to catalyze the EV market in the country. In a NITI Aayog report[52], the cumulative stock of LIBs is estimated to be 15 GWh as of 2020 and demand for LIBs was expected to be 7 GWh in 2021. In the report, the forecast cumulative potential for batteries will be between 419 GWh in the conservative case and 788 GWh in an optimistic case. The annual market will grow from 7 GWh in 2021 to 159 GWh in 2030 in the base case with cumulative demand of 600 GWh. The report assumes a base case of EV penetration reaching 75% in three-wheelers, 70% in two wheelers, 20% in passenger cars and 40% in commercial cars and 30% in buses. In this case, the cumulative battery demand for electric vehicles reaches a total of 380.6 GWh by 2030.

Stationary storage is also a very important demand segment given that India plans to achieve 500 GW of non-fossil fuel capacity including hydro. In addition to flexibility and grid integration of renewable, batteries will be key for distribution and transmission upgrade deferral, commercial and residential behind-the-meter applications and replacements of diesel generators NITI Aayog's report predicts that the demand for BESS could reach up to 182.9 GWh by 2030.

Currently, consumer electronics is the number one demand segment for LIBs in India with major appliances being mobile phones, laptops, power banks, wearable devices etc. The cumulative total ACC demand for consumer electronics is expected to reach 36.4 GWh by 2030.

Initiatives Undertaken by Select Countries

Several countries are working on establishing grid-scale battery energy storage projects and deployment of electric vehicles. Governments, major power generation companies and auto OEMs around the world are making significant investments in setting up the requisite infrastructure for the energy transition as mapped out in the global goal of Net Zero. As such, efforts are being made to secure critical minerals and raw materials like lithium that are bound to experience exponential demand growth. Lithium supply resilience and security has become a top priority across Asia, Europe and the United States.

United States

The United States identifies critical minerals as those which play an essential role in manufacturing of key products whose absence will have significant consequences on the economic and national security of the country and have supply chains vulnerable to disruption[53].

The Federal Government made it a policy mission to reduce the US strategic and security vulnerability to disruptions in supply of critical minerals in a safe and environmentally responsible manner. It sought to achieve this through:

- Identification of new sources of critical minerals
- Increasing activity at all levels of the supply chain encompassing exploration, mining, concentration separation, alloying, recycling, and reprocessing critical minerals.

[52] NITI Aayog, Green Growth Equity Fund Technical Cooperation Facility, Advanced Chemistry Cell Battery Reuse and Recycling Market in India, 2022

[53] Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals, Executive Order 13817, December 20, 2017

- Ensuring access of the most advanced topographic, geologic and geophysical data to minerals and producers
- Streamlining leasing and permitting processes to expedite exploration, production, processing, reprocessing, recycling and domestic refining of critical minerals.

With this view the US Federal Government has formulated its 'Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals' to mitigate risks associated with dependence on foreign suppliers through a complementary and integrated set of strategies. The strategy lists a host of short- and long-term measures, many of which are already being implemented. It identifies six broad areas of action and suggests multiple goals within those areas along with recommendation on pathways that can and are being undertaken to achieve them.

I. Advance Transformational Research, Development and Deployment Across Critical Mineral Supply Chains
   a. Develop an R&D strategy to enhance scientific and technical capabilities across critical supply chains through public-private partnerships to address issues in early-stage research, coordinated R&D targeted at different levels of supply chains, exploring secondary and unconventional sources etc.
   b. Increasing private investment in innovation and improving technology transfer from federally funded science and technology through tax incentives, government purchase programs, providing support to small and medium business regarding critical mineral issues.

II. Strengthen America's Critical Mineral Supply Chains and Defense Industrial Base
   a. Understand and support the critical minerals industry and related supply chain by developing an intra-agency methodology to periodically assess market trends and competitiveness of the US
   b. Leverage critical mineral expertise from stakeholders outside the Federal Government by setting up a National Critical Minerals and Supply Chains Council and convene stakeholders like industry, academia, non-governmental and non-profit organizations as well as local and tribal governments
   c. Develop, expand, modernize and sustain US critical minerals downstream production capacity and supply chain resilience by incentivizing private industry investment specific to national defense needs while focusing on building domestic capabilities, material substitution through investment tax credits, tax exemptions, low-interest loans, workforce training funds, domestic sourcing policy like Buy American Act
   d. Stabilize and strengthen the NDS Program's abilities to respond rapidly to urgent and unanticipated military and essential civilian requirements during US wartime and other national emergencies.

III. Enhance International Trade and Cooperation Related to Critical Minerals
   a. Increase international exchanges with partner nations to share best practices and identify opportunities for trade and collaboration by organizing delegations of US Government officials and private sector representatives to visit partner countries and study how they have addressed critical mineral issues. It identifies Canada, Australia, the European Union, Japan and South Korea as focus countries to expand cooperation in critical mineral resource identification, exploration, processing, recycling, R&D activities and information sharing related to supply, production, investments in and acquisitions of mining properties, rights and development
   b. Secure access to critical minerals through trade and investment with partners, while ensuring that foreign trade practices do no harm US industries and broader national interests by signing Security

of Supply Agreements (SOSAs), Reciprocal Defense Procurements (RDPs) and National Technology and Industrial Base collaborations.

IV. Improve Understanding of Domestic Critical Mineral Resources
   a. Use critical mineral supply and consumption data to develop metrics to enable commodity-specific mitigation strategies addressing strategic vulnerabilities by regular revision of critical mineral lists and categorization and prioritization of minerals
   b. Conduct critical mineral resource assessments and identify methods to encourage the use of secondary and unconventional sources of critical minerals
   c. Improve the geophysical, geological, topographical and bathymetrical mapping of the United States and associated coastal and ocean territory
   d. Improve discoverability, accessibility and usability of geophysical, geological, topographical and bathymetrical data trough data rescue programs and increasing government access to proprietary mapping datasets through public-private partnerships.

V. Improve Access to Domestic Critical Mineral Resources on Federal Lands and Reduce Federal Permitting Timeframes
   a. Revise the Bureau of Land Management's (BLM) and the US Forest Service's land-use planning process to identify and protect access to mineral resources
   b. Complete a thorough review of withdrawals from applicable mining laws and areas restricted from mineral exploration and development on the federal mineral estate
   c. Review travel management plans and existing infrastructure capabilities on Federal lands for impacts to mineral exploration and development
   d. Adopt a model of mineral resource development to track permitting requirements and timelines
   e. Evaluate National Environmental Policy Act (NEPA) and other regulations to provide processing of permit application for mineral projects
   f. Evaluate the Clean Water Act and the Rivers and Harbors Act to improve the permitting processing
   g. Review regulations and consider proposing legislation to facilitate offshore critical mineral development
   h. Evaluate the feasibility of including high-priority mineral projects for review as Fixing America's Surface Transportation (FAST) Act and One Federal Decision Framework.

VI. Grow the American Critical Minerals Workforce
   a. Bolster education in mining engineering, geology and other fields related to critical minerals mining and manufacturing
   b. Promote interdisciplinary collaboration among material science, computer science, and related disciplines to modernize the minerals supply sector industry and make the field more attractive to new talent
   c. Implement personnel and management reform to ensure appropriate human capital to support exploration and development of critical minerals on Federal lands
   d. Facilitate sustained interaction with critical mineral stakeholders and the general public.

Guided by this broad strategy, the US has undertaken several steps to enhance its lithium security. The Critical Materials Institute (CMI), an R&D body funded by the Department of Energy's Advanced Manufacturing Office

under a public-private partnership model has produced several inventions for lithium extraction from brines that have improved the amount of lithium content retrieved from a brine to 90%. Now the aim is to achieve lithium separation rates exceeding 95%. Pacific Northwest and Oak Ridge National Laboratories are currently developing technologies to extract minerals, including lithium and REEs from seawater. The Department of Energy through its Vehicles Technology Office is working to improve supply chain reliability and improve environmental sustainability by focusing on LIB recycling. It is investing in R&D through the ReCell Center and has also announced the Lithium-Ion Battery Recycling Prize[54].

The Federal Consortium for Advanced Batteries, led by the Departments of Energy, Defense, Commerce and State developed the National Blueprint for Lithium Batteries in 2021 to facilitate investments in domestic lithium-battery manufacturing value chain. The blueprint outlines a holistic approach which identifies that US needs work with partners and allies to establish sources and supplies of key raw materials. It also seeks to address key areas such as processing of battery materials where the US lags behind.

European Union

As of 2018, the European Union produced only 3% of the world's lithium-ion battery cells and just 1% of all battery raw materials and it requires 7-18 times more lithium by 2030 to cover the needs of the mobility and energy storage sectors as outlined in its ambitious European Green Deal and the goal to become climate neutral by 2050[55].

European Battery Alliance and Strategic Action Plan for Batteries

The European Battery Alliance was launched by the European Commission in 2017 as a cooperation platform with key industrial stakeholders, Member States and the European Investment Bank with the goal of having cleaner vehicles and more sustainable technology solutions by creating a competitive and sustainable battery cell manufacturing value chain in Europe.

The EU identifies reliance on imported lithium-ion cells that creates concerns regarding security of supply, costs of transportation, time delays, lack of control over quality and design specifications as a key area of concern for EU industry, particularly for automotive OEMs. Given these concerns, the European Commission's Strategic Action Plan for Batteries prioritizes the development of European Li-ion cell value chains.

Under the Strategic Action Plan for Batteries the EC promotes a cross-border and integrated European approach which covers the entire value chain from raw material extraction and production and processing, the manufacturing of cell components, cells, battery packs, their applications in electric vehicles followed by reuse and recycling and finally their disposal. Based on this, the Commission has identified key action areas, one of which is 'Securing the sustainable supply of raw materials.' To achieve this goal, the EC adopted the renewed EU industrial policy strategy that highlights the importance of raw materials, especially critical raw materials. Under this strategy, the EU is working to secure access from resource-rich countries through trade policy instruments and at the same time boosting domestic production and focussing on developing technologies that enable more efficient use of critical battery materials.

[54] A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals, US Department of Commerce
[55] In-depth reviews of strategic areas for Europe's interests | European Commission (europa.eu)

The Action Plan for Batteries also highlights the role of research and innovation in establishing leadership in battery value chains. The research will focus on advanced materials, battery chemistries, advanced manufacturing processes, recycling and re-use. These will be supported through the European Technology and Innovation Platform, Future Emerging Technologies (FET) Flagships, Joint Technology Initiatives and European Institute of Technology's Knowledge and Innovation Communities[56].

European Raw Materials Alliance (ERMA) and Action Plan for Critical Raw Materials

European Raw Materials Alliance (ERMA) was established with the goal of making Europe more economically resilient through supply chain diversification, innovation and investments in raw materials value chains. It is an open and inclusive alliance that provides an open and independent forum for discussion and analysis. The ERMA network consists of more than 350 companies, 100 associations, 70 universities and research organizations along with several financial institutions, national authorities and NGOs from Europe and the world.

The ERMA Cluster on Materials for Energy Storage and Conversion focuses on raw materials that will enable the green energy transition in Europe. ERMA has established an action plan framework and defined concrete actions under four areas: Fuel Cells and Electrolysers, Battery Materials, Alternative Energy Storage and Conversion, and Materials in Solar Energy. ERMA seeks to address strategic developments, technical innovation potentials, regulatory bottlenecks, environmental concerns and civil society. ERMA will help identify and facilitate the necessary investments to support the U's policies on renewable energies. The Cluster functions through two workstreams. First, a value-chain specific consultation process through which it identifies raw material challenges and provide tailored solutions and second, through an investment channel for raw materials projects by installing Raw Materials Investment Platform to bring investors and investees together.

ERMA will support the production of ore concentrates and primary and secondary cell-grade energy storage materials in Europe through investments in greenfield mining.

The European Commission with its aim of ensuring resilience through a secure and sustainable supply of critical raw materials brough out the Action Plan for Critical Raw Materials.

Under this action plan, the Commission established the EU List of Critical Raw Materials to map current and future raw material availability both within and outside the Union. Lithium was added in the 2020 Critical Raw Materials List. The list is an important factor in negotiating trade agreements or seeking to eliminate trade distortions and also helps in identifying potential areas of investment and guiding research and innovation. The action plan also outlines a role for the EU in contributing to global efforts towards better resource management in co-operation with relevant international organisations. It plans to achieve this by diversifying and strengthening global supply chains by collaborating with partners, reducing import dependence and improving resource efficiency. It has set up the European Innovation Partnership on Raw Materials and the Raw Materials Supply Group for this purpose[57].

[56] European Commission, Strategic Action Plan for Batteries, 2018
[57] European Raw Materials Alliance (ERMA) - Homepage

Japan

Japan established its new 'International Resource Strategy' in 2020 against the backdrop of the country's almost total dependence on imports of resources and its vulnerability to a volatile international energy situation. Japan's basic energy policy focusses on energy security, economic efficiency and environmental suitability with underlying emphasis on safety. The new strategy focusses on Japan's key dependencies which include, oil, natural gas, and rare metals as well as its response plan for climate change and de-carbonization.

With respect to mineral resources, Japan has designated 34 'rare metals' which includes Rare Earth Elements (REEs), lithium, cobalt, manganese and host of other metals. Given that markets for rare metals are much smaller in comparison to base metals, they are subject to much higher price volatility which poses significant risk to Japanese industry. This was exemplified by China effectively banning exports of REEs to Japan by slashing export quotas. The aim of the new strategy is to work out approaches towards securing resources through careful risk assessment of individual resources and specialized policy solutions. In order to achieve this, the strategy outlines 3 broad approaches.

The first is diversification of supply sources through acquisition of upstream equities. Japan has identified that in the new business model for mining, the production of raw material and its processing, which earlier used to happen in close geographical conjunction have now been distributed. Individual countries have occupied a significant role in the processing of raw material. The Japan Oil, Gas and Metals National Corporation (JOGMEC) has been supporting projects for mineral resource development in the form of equity support or loan to assist Japanese companies. JOGMEC also provides liability guarantees for loans from private financial institutions. For example, in 2012, JOGMEC provided a liability guarantee to Toyota Tsusho which was participating in the development of Salar de Olaroz lithium development project in Argentina. In 2019, it provided Toyota Tsusho another liability guarantee to expand production in the Olaroz project from 17500 tons to 42500 tons. Through its financial support, JOGMEC has helped Japanese companies acquire strategic mining rights as well as equities in major mining corporations of the world.

The second approach is maintenance of emergency domestic reserves of rare metals. Japan is building up stocks of the 34 identified rare metals based on political situations of their main suppliers, Japan's dependency ratios and its industrial requirements. Japan is employing a model of public-private co-operation to build stocks with a target of accumulating stockpiles worth 60 days of standard domestic consumption. This target has been recommended for review and in expected to be revised upwards given the merging risks associated with evolving industrial structures and increasing importance of these rare metals, and overwhelming supply concentration. While the current targets include both public and private stockpiles, future targets will set for public stockpiling alone and in a flexible manner based on the specific nature of factors pertaining to individual metals.

The last approach is reinforcing the industrial base by engaging in international cooperation with the goal of enhancing supply chains. The Ministry of Economy, Trade and Industry (METI) plans to improve international cooperation with countries involved in various stages of the supply chain from mine exploration and development to production and processing of raw materials as well as final product manufacturing. It seeks to leverage Japan's investment capacity (through JOGMEC) to establish strategic business alliances among Japanese and foreign firms. Improving industrial and technological infrastructures will also form a key component of building international partnerships. Efforts in this direction are being made through collaboration

of government, industry and academia to address challenges including technological development and securing the requisite human capital[58].

United Kingdom

The UK currently relies on complex and delicate global supply chains for its fast-growing demand for critical minerals to fuel its net zero ambitions. The government has recognized that in order to achieve the goals, set under its 'Ten Point Plan for a Green Industrial Revolution' which includes advancing offshore wind, accelerating shift to zero-emission vehicles, creating a green public transport system, achieving jet zero and green ships, and greener buildings, the UK will require a stable supply of critical minerals. In addition to energy transition, critical minerals are also identified underpinning the country's national security and its strategic position in key international situations.

The United Kingdom launched its Critical Minerals Strategy in July 2022 with the aim to ensure that the minerals which will power the world in the future are made available in adequate quantities in a sustainable and responsible manner through transparent and well-functioning markets. It seeks to position the UK at the forefront of the green industrial revolution. The strategy adopts an A-C-E approach i.e., Accelerate, Collaborate and Enhance.

The UK identifies critical minerals as those which are economically vital but also experience major risks to the security of their supply in the form of demand outpacing supply, highly concentrated supply chains, high degrees of price volatility, negligible rates of recycling and low degrees of substitutability in their applications.

To support its strategy, the UK created the Critical Minerals Intelligence Centre (CMIC), led by the British Geological Survey to evaluate the criticality of minerals on an annual basis. Through its first criticality assessment, British Geological Survey (BGS) identified 18 minerals, which includes lithium, cobalt, the REE class of minerals among others as having significant economic vulnerability and supply risk.

The UK's three pronged A-C-E approach deals with three aspects. First is accelerating the UK's domestic capabilities. The government seeks to increase domestic production by enhancing exploration and extraction, providing financial support for development of identified resources, reducing barriers to domestic exploration and extraction and positioning the UK as a strategic location for refining and mid-stream materials manufacturing. The domestic capabilities will be supported further through investments in building the future mining workforce, research and development and building a circular economy through promotion of reuse, recycling and recovery.

The second aspect is collaboration with international partners. Through this, the UK seeks to diversify supply across the world. It also plans to increase intelligence about deep-seabed minerals and assess challenges and opportunities at extracting them as part of this effort. The government will develop bilateral and multilateral diplomatic, trading and development relationships with key countries and support UK companies to participate in overseas supply chains with the goal of jointly working towards solutions to global issues in critical mineral supply chains.

[58] Japan's new international resource strategy to secure rare metals / Special Contents -Energy Japan- / Agency for Natural Resources and Energy (meti.go.jp)

The third and final aspect is enhancing international markets. Under this, the goal is to develop well-functioning and transparent markets through improved data and traceability. Increasing knowledge about location of critical minerals, their trade patterns and their end uses is an important part in achieving this objective. The government will position London as the world's capital of responsible finance and work towards boosting environmental, social and governance (ESG) performance.

Under this strategy, the UK is aggressively supporting upstream activities related to creating a zero-emission vehicles supply chain through the Automotive Transformation Fund (ATF). Two UK firms, Green Lithium, a lithium refiner and Weardale Lithium, a natural resource exploration and development company have secured grants from ATF. The former is building Europe's first large-scale lithium refinery in the UK while the latter is working on exploration, development and feasibility studies for lithium extraction in geothermal brines located in North East England. Cornish Lithium secured investment from the government's Getting Building Fund for constructing geothermal lithium recovery pilot project. The firm has also received ATF funding for a scoping study for its hard rock project in Trelavour. Firms like battery maker Britishvolt and mining major Glencore are looking to build battery recycling ecosystem in UK.

For international collaboration, the UK is working with development banks to direct Overseas Development Assistance (ODA) to like-minded, resource-rich countries to develop critical mineral resources. It is currently sponsoring two deep-seabed mining exploration licenses for 133000 sq. km. of Pacific seabed for UK Seabed Resources (UKSR). The UK formed a Critical Minerals Joint Working Group with Australia to deepen collaboration. It is also working bilaterally as well as through multilateral arrangements, with Canada, the US and South Korea.

To make markets more transparent and address corruption in climate, environment and energy, the government is proposing a new UK Anti-Corruption Strategy to be launched in 2023. The Critical Minerals Intelligence Centre will provide data and analysis on supply, demand and market dynamics of critical minerals. It will also supply insights on factors affecting these markets[59].

Box 6.1: Collaboration among Countries for Securing Critical Minerals

Canada and the United Sates Joint Action Plan

Canada and the United Sates announced the Joint Action Plan for Critical Minerals to secure supply chains for critical minerals needed for important manufacturing sectors like aerospace, defense, LIBs etc. The two countries seek to collaborate on areas such as industry engagement, supply chain diversification, defense supply chains, data exchange and multilateral cooperation. Through this Joint Action Plan, multiple industry engagement session to attract investments and build business tie have been organized. A new online critical minerals mapping portal to improve mineral discovery has been launched. The US and Canada are looking to scale up their ambitions under the Joint Action Plan to advance projects and further promote responsible and sustainable supply chains along with encouraging innovation. The two countries have renewed the Joint Action Plan to accelerate their work in securing the production, processing and recycling of critical raw materials[60].

[59] Resilience for the Future: The United Kingdom's Critical Minerals Strategy
[60] US-Canada Supply Chains Progress Report, 2022

The Conference on Critical Materials and Minerals

The Conference on Critical Materials and minerals commenced in 2011 as a trilateral engagement among the EU, US and Japan in response to soaring prices of rare earth minerals and other critical materials. In 2021, the Australia and Canada also became members. The conference serves as a platform for the exchange of information on policies for critical materials, R&D and other efforts under the framework of multilateral cooperation. In the latest, 12th Conference, held in December 2021, the parties discussed the development of technologies related to critical materials. The participants exchanged information related to batteries, power generation and motor technologies to support an electrified society. Recycling and environmental technologies for a circular economy were also on the agenda[61].

Strategies Adopted by India

India is projected to require large supplies of lithium to achieve its battery manufacturing, electric mobility, energy storage and energy transition targets. As discussed in this chapter, the world's leading economies are working rapidly in securing lithium supplies in order to reduce the vulnerabilities of their energy and manufacturing industries as well as for national security. It is imperative for India to make similar headway in order to safeguard its long-term interests.

International Engagement

India has been utilizing its diplomatic associations in other countries for collaborations in joint exploration activities for critical and strategic minerals.

Khanij Bidesh India Ltd. (KABIL) has been promoted as a joint venture of three Central Public Sector Enterprises, viz., National Aluminum Company Ltd. (NALCO), Hindustan Copper Ltd. (HCL) and Mineral Exploration Company Ltd. (MECL). It has been set up with the objective of ensuring a consistent supply of critical and strategic minerals to the Indian domestic market. KABIL is set up to carry out identification, acquisition, exploration, development, mining and processing of strategic minerals overseas for commercial use and meeting domestic requirements. The minerals will be sourced through creation of trading opportunities, government-to-government collaborations and strategic investments in exploration and mining assets of these minerals in source countries.

Through a commissioned study, KABIL has identified 12 minerals where it seeks to promote international cooperation and build business partnerships. These are, Lithium, Cobalt, Germanium, Indium, Beryllium, Niobium, Selenium, Gallium, Tantalum, Tungsten, Bismuth and Tin. Out of these 12, Lithium and Cobalt have been identified as being the most critical and strategic in nature.

Based on a commissioned study and selection criteria, select source countries have been shortlisted for exploring possibilities of mineral asset acquisition abroad. So far, engagements are underway with select source countries such as Australia, Argentina, Bolivia, Chile etc. which are endowed with the cited critical and strategic minerals specifically Lithium and Cobalt in hard rock formations as in Australia and Lithium as brine in the huge tract of Salars as in Latin American countries. The interface has been the respective Embassies and Missions of India in those countries for sharing of information with respect to prospective mineral acreages primarily with state owned organisations for taking up due diligence and investment decisions[62].

[61] 12th Conference on Critical Materials and Minerals (meti.go.jp)
[62] India's Efforts to Attain Self-Reliance in Critical and Strategic Minerals, Ministry of Mines, PIB Press Release, March 2022.

Memorandum of Understanding (MoU) with Australia

On 3rd June 2020, the Indian Ministry of Mines and Australia's Critical Minerals Facilitation Office (CMFO) signed a G2G MoU for cooperation in the field of mining and processing of critical and strategic minerals.

Under this broader memorandum, a detailed MoU was signed between KABIL and CMFO on 10th March 2022 for carrying out joint due diligence of select greenfield and brownfield projects to identify lithium and cobalt minerals assets for joint investment decisions and acquisition of assets in Australia. An initial investment of US$ 6 million has been committed by both countries in equal partnership. The MoU provisions for any other CPSE to be on-boarded as an investment partner in asset acquisition. The MoU is based on the principles of providing a collaborative framework for enhancing India-Australia partnership in the critical mineral ecosystem; supporting strategic national interest through investment in Australian critical mineral projects; and developing a robust and commercially viable critical minerals supply chain that fosters innovation, sustainability and reliability of supply.

Memorandum of Understanding (MoU) with Argentina

On 2nd June 2021, the Cabinet approved the MoU between the Ministry of Mines and Argentina's Secretariat of Mining under Argentina's Ministry of Productive Development. The MoU seeks to create an institutional framework for cooperation in mineral resources. Through this MoU, the two countries will encourage collaborative efforts in minerals exploration and development, including extraction, mining and beneficiation of lithium. Possibilities of forming joint ventures in the field of base metals, critical and strategic minerals, exchange of technical and scientific information, training and capacity building and promotion of investment and development in the mining sectors will be explored. KABIL has also signed a non-binding MoU with three state-owned organizations of Argentina for the purpose of information sharing with respect to prospective mineral acreages of lithium.

Domestic Exploration

Under the annual Field Season Program (FSP), the Geological Survey of India (GSI) has taken up 20 Lithium projects in the last five years in Andhra Pradesh, Arunachal Pradesh, Bihar, Chhattisgarh, Himachal Pradesh, Jharkhand, Jammu & Kashmir, Madhya Pradesh, Meghalaya, and Rajasthan. Under FSP 2022-23, GSI has taken up 18 Lithium projects in 6 states and 1 Union Territory.

The Atomic Minerals Directorate for Exploration and Research (AMD) under the Department of Atomic Energy (DAE) is also carrying out lithium exploration projects in parts of Mandya and Yadgir districts of Karnataka[63]. Preliminary surveys on surface and limited subsurface exploration by AMD, have shown presence of Lithium resources of 1,600 tonnes (inferred category) in the pegmatites of Marlagalla – Allapatna area, Mandya district, Karnataka. However, the significance and commercial viability of the discovered deposits will require complete exploration of the area followed by technical, social and economic feasibility studies.

Geological Survey of India has for the first-time established Lithium inferred resources (G3) of 5.9 million tonnes in Salal-Haimana area of Reasi District of Jammu & Kashmir (UT)[64].

[63] Press Information Bureau, Government of India
[64] Geological Survey of India Finds Lithium and Gold Deposits, Ministry of Mines, PIB Press Release, February 2023.

Chapter

Policy Recommendations

Improving Trade Relations

India faces a large trade deficit on aggregate with the Lithium Triangle countries. Therefore, it needs to focus its attention on expanding its exports to the three countries. A list of products have been identified where India has potential to increase its merchandise exports. These products are - plastics and articles, machinery and mechanical appliances, electrical machinery and equipment, optical, photographic, measuring, checking, medical or surgical instruments, mineral fuels and oils, pharmaceutical products, iron and steel, miscellaneous chemical products, articles of iron and steel, rubber and articles and ores, slag, and ash.

The most important factor holding back trade expansion between India and the Lithium Triangle countries is trade costs including those arising from tariff and non-tariff barriers as well as transportation and logistics. India has been successfully able to almost eliminate its deficit with Chile, in part through increasing exports which came as a result of a successful preferential trading agreement which was expanded in 2017. The two countries plan to further expand the PTA from 2000 to 5000 tariff lines and bring trade in services and investment into its fold as well.

Argentina actively uses trade policy measures as instruments to attain its long- and short-term objectives, such as promoting overall economic growth and containing inflation. It has designed its trade policy to boost exports and promote domestic production through import substitution. It uses mechanisms such as export duties, registration requirements and import licensing to achieve desired results. This requires constant policy adjustment, which increases complexity of the trade regime. India is in an unfavourable position in terms of exporting to Argentina as it faces a weighted average effective applied tariff of 12.16% against world average of 7.26% in 2019. Argentina applies relatively higher tariff on a number of products of export importance to India like textiles, fuels, machinery and electrical equipment. The tariff structure of Chile, which is an outward oriented economy, is extremely homogeneous and consists of only two tariff lines of 0 and 6 percent with 6 per cent rate on 99.6 per cent of lines and 0 per cent rate on only 35 lines. However, Chile's average effective applied tariff rate on imports from the world was just 0.43% in 2019 as compared to effective applied average tariff of 5.61% on India. This is because Chile has comprehensive FTAs with most of its major trade partners. In Bolivia too, India faces a tariff disadvantage. The average AHS tariff applied on imports from India was 8.33% versus 4.73% on imports from the world[65].

Therefore, India needs to evaluate the scope of bilateral PTAs with Argentina and Bolivia as well as the potential for an FTA with Chile. India also need to work on reducing shipping costs for its exports to South

[65] World Bank WITS – UNCTAD TRAINS Database

America. Logistics play a key role in determining trade flows and strengthening economic relations between the two regions. India needs to develop direct shipping services to the Latin American region in order to bypass transshipment hubs. It needs to develop its warehousing facilities in the region as well as build domestic shipping lines to reduce transaction costs.

Developing the Indian Mining Sector

India will not be able to fully secure its requirements for lithium and other minerals critical for energy transition without building robust domestic mining capabilities. As per Fraser Institute's Annual Survey of Mining Companies, 2016, India ranked 97 out of 104 jurisdictions in the Investment Attractiveness Index for the mining sector. However, India has a high geological potential for minerals. Most of the mineral exploration and mining in India has taken place for coal, iron ore, and surficial minerals while deep seated and concealed minerals remain largely untapped. Enhancing the resource base and reserves through exploration, reducing regulatory delays, building infrastructure, human capital and technological capabilities, and creating a robust information, education and communication strategy are essential for improving mining prospects of the country.

The Council for Energy, Environment and Water (CEEW) published a study, 'Critical Non-Fuel Mineral Resources for India's Manufacturing Sector: A Vision for 2030' which pointed out that less than 10% of India's total landmass has been geo-scientifically surveyed for assessment of underlying mineral wealth. The absence of reliable baseline data acts as a major deterrent for private agencies to invest in exploration and process R&D.

A strong domestic private sector in the mining sector, which is capable of undertaking large-scale risky investments is likely to be in a much better position in undertaking international lithium exploration and mining and ensuring that lowest-cost lithium is made available for domestic battery manufacturing requirements.

Creating a Minerals Knowledge Center

Currently the Indian Bureau of Mines publishes data related to only minerals which have considerable deposits located in India. However, India has not yet officially identified a list of critical minerals that are believed to be crucial for future economic development. It is important to build a repository of information that contains detailed information about domestic and international resources and reserves of such minerals. Such a repository should also contain information related to major suppliers, trends of demand and supply, and prices of these minerals. It is also important to study the supply chains of critical minerals and understand the economic, political and environmental factors that affect them. Information of this calibre is essential for taking informed policy decision and prioritizing efforts towards minerals that face the highest risks of supply uncertainty. Currently lithium is not traded on global commodity exchanges which means important market information related to it is scarce and not available in a transparent and reliable manner.

Research and Development

The primary reason for the global race towards securing lithium is its requirement in the manufacturing of lithium-ion batteries. India currently does not possess significant domestic resources of lithium making it entirely import dependent. Therefore, in addition to acquisitions of international mining concessions, R&D efforts to optimize methods of extraction, concentration, separation and purification of minerals to increase yields and make supply more resilient is necessary. Research efforts could be undertaken in new extraction

methods like Direct Lithium Extraction (DLE), which are not only cheaper but also have the potential to reduce lead times for raw material.

Investments in research and development of advanced battery technologies with higher energy densities and increased number of charge-discharge cycles will help India become more resource efficient. The ACC PLI is a right step as it incentivizes investments in such advanced lithium batteries as well as alternate chemistries. Given that India aims to be a major manufacturer of batteries to be used in electric vehicles, energy storage etc., it should also focus attention on battery recycling technologies as well as repurposing and reuse of batteries from one end-use to another.

Developing a Comprehensive Critical Resource Strategy

India has not yet developed a national policy for securing critical mineral supplies. It is essential to create a policy roadmap that charts an action plan taking into consideration where India's strengths and weakness lie in terms of critical mineral resources. A framework that clearly identifies objectives; sets the requisite set of strategies and actions and defines a mechanism, through which progress can be measured is important for ensuring synchronization and reducing the possibility of wasted time and effort. An overarching framework is necessary to ensure that decisions follow a long-term vision and actions of various entities are synchronized to achieve national objectives. India's efforts at improving diplomatic ties with the Lithium Triangle countries as well as the work of KABIL in acquiring mining interests in these countries should be integrated as part of a broad strategy that defines clear roles and expectations.

Capturing Value in Battery Supply Chains

India aims to be an important manufacturer of lithium-ion batteries, globally. In order to achieve this goal, it would require refined lithium compounds among other intermediate products used in the production of LIBs. However, currently, refined lithium products are not actively traded in international markets. The countries producing these products, like China, Japan and South Korea, employ this for their domestic battery manufacturing operations where the largest contribution to value added in the supply chain occurs. Hence, sourcing such compounds at cost-effective prices can prove to be a challenge and have implications at international competitiveness of made-in-India batteries. Therefore, building domestic lithium processing and refining capabilities would be important in improving India's cost competitiveness as a supplier in global battery markets. Building such capabilities would provide raw material suppliers like Lithium Triangle Countries with an alternative market and provide countries like Japan and South Korea an alternative source of supply for intermediate inputs.

Creating such capabilities is also important for India to achieve a position of strength when it looks to enter into international collaborative efforts for securing critical resources like lithium. Currently, India is not part of the equation when economies like the US, EU, Japan, South Korea, Australia, the UK etc. are seeking mutual cooperation, because India does not play a significant part in global battery value chains. Being part of international partnerships is important to ensure resource supply resilience and sustainability.

Seeking Common Grounds

While reaching out to resource rich countries like Argentina, Bolivia and Chile, it is important to move beyond transactional ties and build relationships founded on shared national development goals. These countries

have a lot of shared interests in improving their energy securities. Similarly, Argentina and India both have underdeveloped mining sectors, and this raises possibilities in joint efforts towards exploration, research and development. With high levels of public debt, the development projects geared towards improving infrastructure are of critical importance to Bolivia. In this context, Bolivia especially values projects aimed at improving transportation and trade infrastructure being a land-locked country. India, thus, has an opportunity, to not just become a trade partner but also a valuable partner in narrowing the gaps in Bolivia's infrastructure.

Box 7.1 : Increasing Role of Export Credit Agencies in Financing Critical Minerals

Recently, the United States has convened the Mineral Security Partnership (MSP) with key minerals-rich countries to discuss priorities, challenges, and opportunities in responsible mining, processing, and recycling of critical minerals. First announced in June 2022, the MSP is a new multilateral initiative to bolster critical mineral supply chains essential for the clean energy transition. The MSP aims to ensure that critical minerals are produced, processed, and recycled in a manner that supports countries in realizing the full economic development potential of their mineral resources. The MSP aims to attract public and private investment, increase transparency, and promote high Environmental, Social, and Governance (ESG) standards throughout critical minerals supply chains. MSP partners participating in the meeting included: Australia, Canada, Finland, France, Japan, South Korea, Norway, Sweden, the UK, the US, and the EU. Additional minerals-rich countries in attendance included Argentina, Brazil, DR Congo, Mongolia, Mozambique, Namibia, Tanzania, and Zambia. The MSP is currently considering promising critical minerals projects that could be of interest to one or more MSP partners, promoting innovation, developing a joint approach on ESG standards, and engaging both project operators and minerals-producing countries. In this context, the Export Import Bank of the United States has signed a co-financing agreement with Korea Trade Insurance Corporation (KSURE) in September 2022. The new partnership will create a one-stop shop facility that will provide joint support for the US and Korean export projects in new and strategic industries, including critical minerals[66].

In 2021, the Australian government established the Critical Minerals Facility. The Facility is managed by the export credit agency, Export Finance Australia and provides financing to projects that are aligned with the Australian Government's Critical Minerals Strategy. The Facility has been funded with US$ 2 billion AUD to help projects suffering from gaps in private finance to overcome these gaps and get off the ground. The funding can come in the form of loans, loan guarantees, bonds and working capital support and is intended as a complement to commercial financing.

[66] Minerals Security Partnership - United States Department of State

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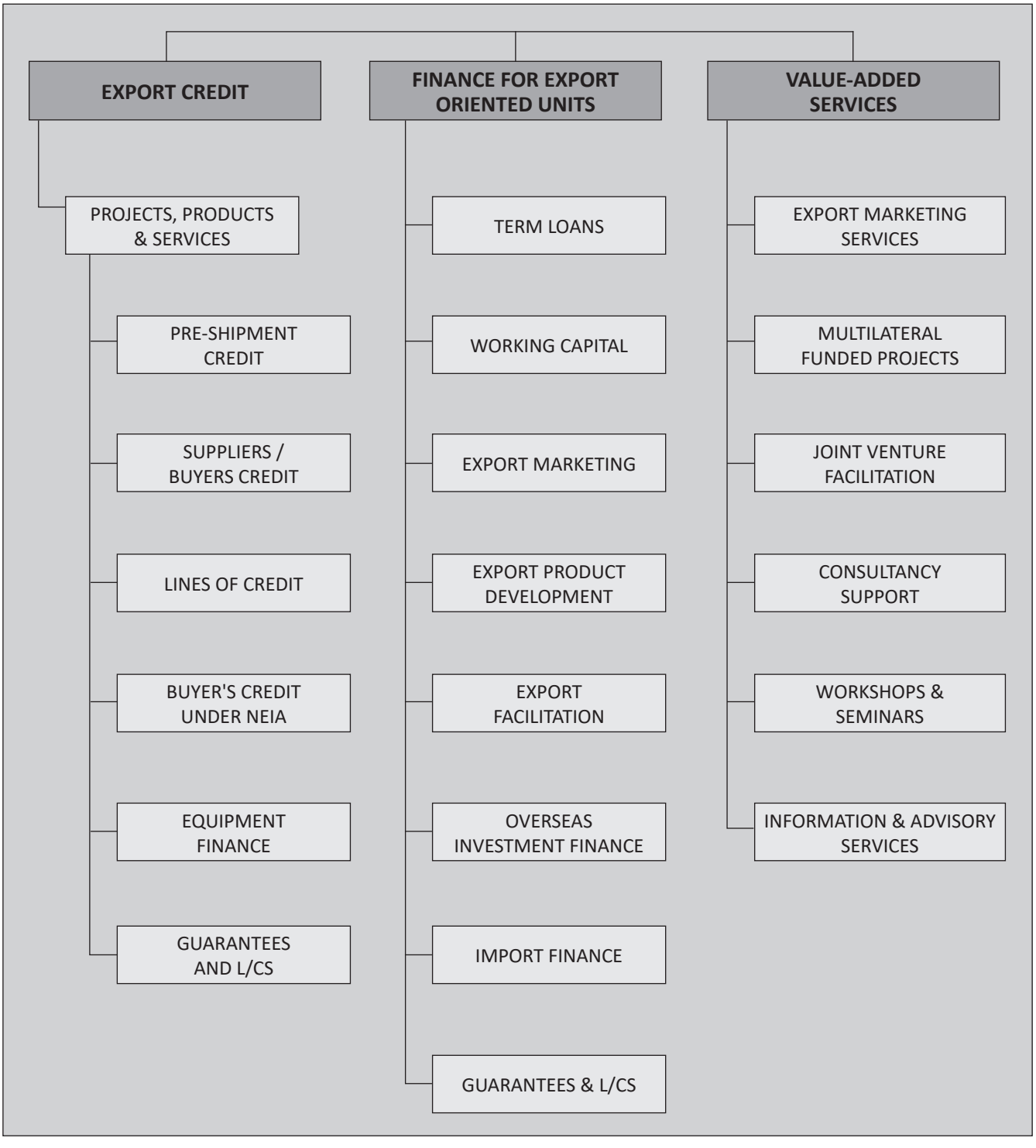

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