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Analysis of Minerals and Metals Sector of Pakistan
The Case of Gypsum

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List of Abbreviations

Alphabets	Abbreviation	Explanation
B	Bn	Billion
F	FY	Fiscal Year
	Ft	Feet
	FTA	Free Trade Agreement
G	GCC	Gulf Cooperation Council
H	HS Codes	Harmonized System Codes
I	ITC	International Trade Center
K	KG	Kilogram
	Km	Kilometer
M	MMT	Million Metric Tons
	Mn	Million
	MT	Metric Tons
P	PKR/Rs	Pakistani Rupee
U	UN	United Nations
	USD	United States Dollar

Executive Summary

Pakistan has huge mineral reserves covering an outcrop area of 600,000 square Kilometer. There are currently 92 identified minerals, 52 of which are commercially mined, with a total annual production capacity of 68.52 MMT. The sector grows at a rate of 2 to 3 percent per year on average. One of the most important in these minerals is gypsum and its related products, which were extracted at 2.47 MMT in fiscal year 2020. Despite possessing vast riches, Pakistan has been unable to realize its full potential. Furthermore, gypsum has a wider market with a $ 1.5Bn global demand. The world is transitioning away from carbon-emitting products and toward greener alternatives, and gypsum products are in high demand both locally and globally.

In FY19, 2.36MMT Gypsum was extracted but after that, the extraction witnessed a decreasing trend because of trade barriers with India as well as the pandemic which has slowed down the global economic activity in 2020. Despite of these factors, the demand of gypsum products will increase owing to the incentives given to construction industry by the federal government.

Pakistan's neighboring country Iran extracted 16 million metric ton (MMT) 2019, which is 8 times more than our extracted value. In 2020, Iran has exported its raw gypsum of amount $ 25 Mn of which it exported $ 9 Mn to China, $ 7 Mn to India and $ 4.5 Mn to Qatar. Pakistan, despite having good relations with China and Qatar, has not exported a substantial amount to any of these countries. The reason is that Pakistan has not explored the other potential markets and relied mainly on Indian local farmers' demand which now has stopped due to trade restrictions.

Pakistan is behind in the competition because of lack of focus on increasing the extraction of raw gypsum, in addition lack of use of technology in mining makes it uncompetitive in international market. The other reason is the country only focuses on exporting raw materials rather than adding value to it to make more revenue.

To capitalize on the potential of the international market and the shortage of gypsum extraction, there is a need to enhance present extraction levels by improving mining practices in the country and minimizing loss during mining.

Pakistani authorities need to give awareness about the product to its miners and manufacturers, additionally, resolving the energy woes so that uninterrupted mining and processing can be done.

A separate mining zone is suggested that can be established to have a complete value-chain at one place so that our products would be more competitive in the international market.

Adopting modern techniques in mining to increase productivity as well as reducing wastage and protect the environment is a pre-requisite. Moreover, setting-up processing units near the quarries to reduce cost of transportation and Shifting from traditional export pattern to new markets like, Japan, Sri-Lanka and USA will bring foreign exchange in the country.

Chapter 1 Introduction

Pakistan is endowed with huge reserves of minerals covering an outcrop area of 600,000 sq. Km. There are 92 known minerals of which 52 are commercially mined with a total production of 68.52 MMT per year. This is a promising with an average annual growth rate of 2-3%. This sector contributes economy with above 5,000 operational mines, 50,000 SMEs, and direct employment of 300,000 workers.

Pakistan has the world's 2nd largest salt mines and 5th largest copper and gold reserves, and 2nd largest coal deposits, as well as estimated billions barrels of crude oil. Despite these resources, mineral sector is showing sluggish performance. During Jul-Mar FY21, its contribution to GDP remained at 2.38% (Economic Survey FY21). While Pakistan's mineral exports are only about 0.1 % of the world's total exports. In year 2020, Pakistan's total mineral and metals exports were around $ 1.18 Bn as compared to the world's $ 1,490 Bn (UN Comtrade).

Pakistan is also blessed with abundant reserves of Gypsum. Total gypsum reserves are approx. 4.8Bn with the extraction capacity of 2.1 million metric tons annually. The total demand of gypsum is estimated at 2.1 million metric tons and the demand is met through local extraction.

Gypsum reserves are concentrated in Khyber Pakhtunkhwa (KPK). It is estimated that about 92% of Pakistan's gypsum reserves, that is, 4.2 Billion tons exist in Khyber Pakhtunkhwa. The gypsum production of the province from 70 mines is estimated to be 1.9 million tons per annum.

The processing industry of gypsum was initiated in Kohat division after the discoveries of gas and oil in Karak in 2007. These production units were mostly established at roadside in vicinity to the mines that is a global practice due to the bulky nature of gypsum. Currently, there are 158 processing factories including plaster of Paris plants, gypsum powder units, and crush plants

The exports of gypsum in fiscal year 2018-19 was $ 10Mn, mainly to India and after trade restrictions it was declined. Several studies have been conducted on gypsum and its allied products. More recently SMEDA also conducted field survey of Kohat where high quality Gypsum is found. The study will highlight the key challenges in extracting gypsum and will address the potential markets of gypsum where Pakistan is not exporting a ton of it.

1.1. Significance of the Study:

Although Pakistan has gypsum resources in abundance, yet consolidated and aligned with latest economic system, strategy for exploitation does not exist. A number of works in pieces exist, its small reflection may be domestic demand centered or local production etc. There is a dire need to analyze the gypsum potential, its analysis in domestic and international perspective, future trends.

1.2. Objectives of the Research:

Main objectives of the research are to highlight brief overview of mineral sector demand, and largely the demand of gypsum, its linkage with the domestic and international market. Identification of gaps in exploitation and capitalization of gypsum in Pakistan, potential intervention in capitalization. Propose a number of interventions for improved exploitation, enhanced efficiency and capitalization of gypsum resources in Pakistan.

This research is also organized to highlight international demand of gypsum in different the regions of the world. Initial part over views Pakistan's mineral resources and overview of gypsum mineral, potential interventions for improved exploitation of mineral resources. Later part proposes a framework for improved exploitation of gypsum resources, enhancement of efficiency and better capitalization of the potential.

Chapter 2 Minerals and Metals Profile

2.1. Minerals in Pakistan

Estimated figures of Mineral resources taken from a research are mentioned below (Ashraf & Cawood, 2016) and (Ministry of Finance, FY21)

Figure 1

Estimated Reserves

Source: Ministry of Finance and Ashraf & Cawood 2016

Chapter 3 Regional Comparison

3.1. Minerals and Metals Trade – Comparison with China and India

Overall minerals and metal's exports of Pakistan during 2020 were $ 1.8 Bn. Major Export items at 2 digits HS code level (Chapter Level) included Salt, Sulphur ($ 433 Mn), Copper ($ 354 Mn). While imports of mineral were recorded at $ 4.7 Bn with leading imports of Iron & Steel products ($ 3Bn).

Table 1

Exports of Minerals

Mineral Description (HS 2 digit	World's Exports ($ Mn)	Pakistan's Exports ($ Mn)	China Exports ($ Mn)	India Exports ($ Mn)
HS 25 Salt; Sulphur	45,403	433	3,306	2,005
HS 26 Ores, slag and ash	238,636	94	1,816	3,029
HS 72 Iron and steel	366,760	63	39,464	9,774
HS 73 Articles of iron or steel	306,026	66	69,554	7,251
HS 74 Copper	146,157	354	6,784	899
HS 75 Nickel and articles	26,370	0	919	94
HS 76 Aluminum and articles	175,309	42	26,108	5,244
HS 78 Lead and articles	7,242	4	64	398
HS 79 Zinc and articles	16,778	4	334	556
HS 80 Tin and articles	4,968	0	112	11
HS 81 Other base metals; cermets	18,008	0	3,536	50
HS 82 Tools, implements, of base metal	65,367	114	16,680	890
HS 83 Miscellaneous articles of base metal	72,981	4	19,630	666
Total	**1,490,006**	**1,179**	**188,308**	**30,867**
				Source: UN Comtrade

Table 1 indicates that total exports of China of minerals and metals, in 2020, has been $ 188 Bn, whereas India exported $ 30 Bn. Pakistan lags behind regional countries, as total exported value for the year 2020 has been $ 1.18 Bn.

India imported worth $ 11 Bn Iron and Steel and expotrted worth $ 9.7 Bn. This scenario indicates that India imports raw material for making steel and than exports the same products by value addition at higher prices.

Table 2 indicates that Minerals imports of Pakistan were recorded at $ 4.7 Bn. During 2020 Pakistan highest imports in metal and mineral sector were recorded in Iron and steel i.e. $ 3 Bn.

Pakistan is underutilizing this sector and importing despite of having huge reserves due to lack of focus on mining of the available reserves. This is exhasuting import bill of Pakistan overall despite of taking advantage by value addition.

This indicates that Pakistan has a potential to reduce its imports by focusing largely on mining of available reserves and then making value-added products.

Table 2

Imports of Minerals

Mineral Description (HS 2 digit)	Pakistan's Imports ($ Mn)	China's Imports ($ Mn)	India's Imports ($ Mn)
HS 25 Salt; Sulphur	136	8,135	2,731
HS 26 Ores, slag and ash	2	163,606	2,755
HS 72 Iron and steel	3,096	23,357	11,800
HS 73 Articles of iron or steel	754	9,854	5,024
HS 74 Copper	177	40,808	5,189
HS 75 Nickel and articles	17	5,509	745
HS 76 Aluminium and articles	344	5,794	4,600
HS 78 Lead and articles	12	371	664
HS 79 Zinc and articles	49	2,093	681
HS 80 Tin and articles	6	159	222
HS 81 Other base metals; cermets	10	3,123	454
HS 82 Tools, implements, of base metal	88	3,506	1187
HS 83 Miscellaneous articles of base metal	80	1,876	984
Total	4,770	268,192	37,035

Source: UN Comtrade

Mineral sector of Pakistan has a potential to bring economic change to the country if capitalized efficiently. So far, Pakistan has not really been able to harness them to bring that change. This makes it imperative to look for all options for accelerated value creation and wealth generation. Many countries have used their mineral resources very effectively for the purpose of economic growth. Taking an example from neighboring country; India fetched foreign exchange worth $ 29 Bn through the export of gems and jewelry in FY20 along with exports of other ores and value

added minerals valuing at $ 4 Bn. It became the world's second largest crude steel producer in 2019 with production at 111.2 MT. Brazil and Chile have also established themselves as mining giants while securing a stable income of more than $ 30 Bn from exports (Tribune, 2021)[1].

Chapter 4 Pakistan's Minerals Extraction

4.1. Extraction of Principal Minerals

Table 3 represents the extraction of minerals officially reported by Ministry of Finance over 3 years in Pakistan and out of these, four minerals are those which were extracted in large quantity i.e. in million metric tons (MMT), include: Coal (8.428 MMT), Lime Stone (70.81 MMT), Rock Salt (3.653 MMT), Marble (8.81 MMT) and Gypsum (2.47 MMT). This report focuses on Gypsum and its allied products as the world is shifting from carbon emitted products to a green environment and products from Gypsum are in great demand locally as well as globally.

Table 3
Pakistan Extraction of Selected Minerals

Minerals	Unit of Quantity	FY18	FY19	FY20	9MFY20	9MFY21	% Change FY20/FY21
Coal	M.T	4,477,555	5,406,878	8,428,237	6,081,053	5,717,931	-5.97
Chromite	M.T	97,420	138,244	121,435	66,883	85,798	28.28
Magnesite	M.T	23,596	42,996	16,165	14,467	15,360	6.17
Dolomite	M.T	488,825	472,474	302,045	254,986	121,674	-52.28
Gypsum	M.T	2,475,893	2,517,825	2,149,873	1,575,830	1,208,441	-23.31
Lime Stone	M.T	70,818,725	75,596,328	65,809,924	51,061,090	46,485,992	-8.96
Rock Salt	M.T	3,653,746	3,799,106	3,368,978	2,546,454	2,685,023	5.44
Sulphur	M.T	22,040	20,715	19,948	15,086	14,920	-1.1
Barytes	M.T	88,847	116,480	55,341	37,892	17,807	-53.01
Iron Ore	M.T	677,206	627,464	573,695	430,677	543,641	26.23
Soap Stone	M.T	141,504	156,935	150,009	123,469	103,785	-15.94
Marble	M.T	8,813,025	7,736,443	5,796,879	4,777,066	2,146,315	-55.07
Bauxite	M.T	145,189	92,936	101,047	75,408	75,012	-0.53
Quartz	M.T	125,014	112,308	4,592	4,292	2,332	-45.67
Ocher	M.T	75,939	81,502	132,144	113,343	86,628	-23.57
							Source: Ministry of Finance

Chapter 5 Case Study of Gypsum

Gypsum is an evaporative mineral most commonly found in layered sedimentary deposits in association with halite, anhydrite, sulfur, calcite, and dolomite. Gypsum (CaSO4.2H2O) is very

[1] https://tribune.com.pk/story/2282136/mining-an-engine-of-progress

similar to Anhydrite (CaSO4). The chemical difference is that gypsum contains two waters and anhydrite is without water.

5.1. Products made of gypsum

Following are value-added products of gypsum available in the market;

- Plaster of Paris
- Plaster Boards
- Gypsum Powder for soil conditioning
- Cement as a hardening retarder
- Dental plaster, dental
- Orthopedic applications (bandages, gauze, etc.)
- Gypsum Lamps
- Decorative

From the above-mentioned products, Pakistan has been exporting only Plaster of Paris and Gypsum Powder. After 2019, exports of gypsum have been affected by the trade restrictions imposed on trade with India by the government of Pakistan. On the other hand, gypsum has huge share in the international market of around $ 2Bn.

International target markets for above value-added products are USA, Japan, France, Sri-Lanka, India, Indonesia, and China.

Pakistan is behind in the competition because of lack of focus on increasing the extraction of raw gypsum, in addition lack of use of technology in mining makes it uncompetitive in international market. The other reason is the country only focuses on exporting raw materials rather than adding value to it to make more revenue.

5.2. Gypsum Deposits in Pakistan

Figure 2 demonstrates the geological mapping of gypsum reserves in Pakistan. This map indicates the actual site of the reserves.

Current Gypsum deposits of Pakistan are found in Punjab (Dera Ghazi Khan, Mianwali and Jhelum areas of Salt Range & Suleman Range), Sindh (Ganjo Takkar area of Hyderabad) and Baluchistan

(Sibi Region). Khyber Pakhtunkhwa (Kohat-Bannu Region) has largest reserves of gypsum i.e. 90% of total reserves (4.3 Bn Tons) (SMEDA, Cluster Development Program, 2017).

Figure 2

Geo-mapping of Gypsum Reserves in Pakistan

Source: Google Maps

5.3. World Gypsum Production and Reserves

The extraction of gypsum is done in developed and developing countries as shown in Table 2. USA has a large reserves (700 Bn Tons) of gypsum, of which it extracted 20 MT in 2019. Despite having huge reserves, the USA has imported $ 150Mn value of raw gypsum in 2020 which shows that the extraction is not meeting the local demand.

5.3.1. Regional Comparison and Market Analysis

On the other hand, Pakistan's neighboring country Iran extracted 16 MT in 2019, which is 8 times more than our extracted value. In 2020, Iran has exported its raw gypsum of amount $ 25 Mn of which it exported $ 9 Mn to China, $ 7 Mn to India and $ 4.5 Mn to Qatar. Pakistan, despite having good relations with China and Qatar, has not exported a substantial amount to any of these countries. The reason for this is that Pakistan has not explored other prospective markets and has

depended mostly on demand from Indian local farmers, which has now ceased owing to trade restrictions.

Table 4
World Mine Production and Reserves of Gypsum

Countries	Mine production (2019) - Mn Tons	Reserves (Bn Tons)
USA	20.0	700
Canada	3.0	450
Brazil	3.2	340
Turkey	10.0	200
India	2.7	37
Pakistan	2.1	4.8
Thailand	9.3	1.7
Algeria	2.5	NA
Iran	16.0	NA
Other countries	71.2	NA
World Total	140.0	Large
Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2020		

5.4. Mining Process

In order to extract valuable minerals from the Earth, mining process is required. Minerals are extracted in raw form. They are then supplied to processing units for further value addition. In Pakistan minerals are usually sold in raw form or semi-processed form.

Scope of this research is limited to mining and processing in Kohat region because of largest available reserves.

5.4.1. Small Scale Mining

Small-scale mining is often done with primitive methods. This type of mining is labor-intensive. Miners practice blasting method and manual drilling where they are unable to reach which is then manually loaded on dumpers. This requires lot of labor and time. This process entails blasting of mining area with explosives. Mining area is usually leased based on availability of mineral reserves. In this mining practice, more than 40% gypsum is wasted and less production is being done on daily basis (Ministry of Planning, 2018).

Figure 3

Small Scale Mining Process

Source: **SMEDA**

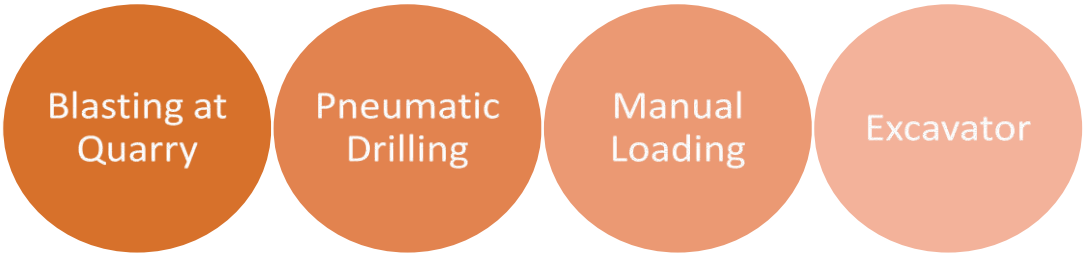
5.4.2. Medium Scale Mining

The process of medium-scale mining shown in Figure 34 is either done with the help of used pneumatic drilling machinery or by use of second hand heavy earth moving machinery. The first method is applied at points with heights impossible to reach with heavy machinery. Owing to the difficulties in obtaining explosives, the cluster is quickly shifting to the use of excavators for gypsum extraction and then rock splitting with the attached Jack Hammer. Majority of such mine owners arrange excavators on rental which are available at Tarnol (Rawalpindi) as well as Chungi (Karak).

All of the mines produce boulders of handpicking size. Only a few of them, having heavy earthmoving machinery can break handpicks into smaller sizes by using Jack Hammers. Normally, the product of gypsum mines is in the shape of rock bigger than 2 ft in size, which is then crushed as per its application either by labor or by Jack Hammer. Few advanced mines with heavy earth-moving machinery also crush it below 2 ft through Jack Hammers (Ministry of Planning, 2018).

Figure 4

Medium Scale Mining Process



Source: **SMEDA**

5.5. Gypsum Extraction and Trade

In FY19, 2.36MMT Gypsum was extracted but after that, the extraction witnessed a decreasing trend because of trade barriers with India as well as the pandemic which has slowed down the global economic activity in 2020. Despite of these factors, the demand of gypsum products will increase owing to the incentives given to construction industry by the federal government.

Table 5

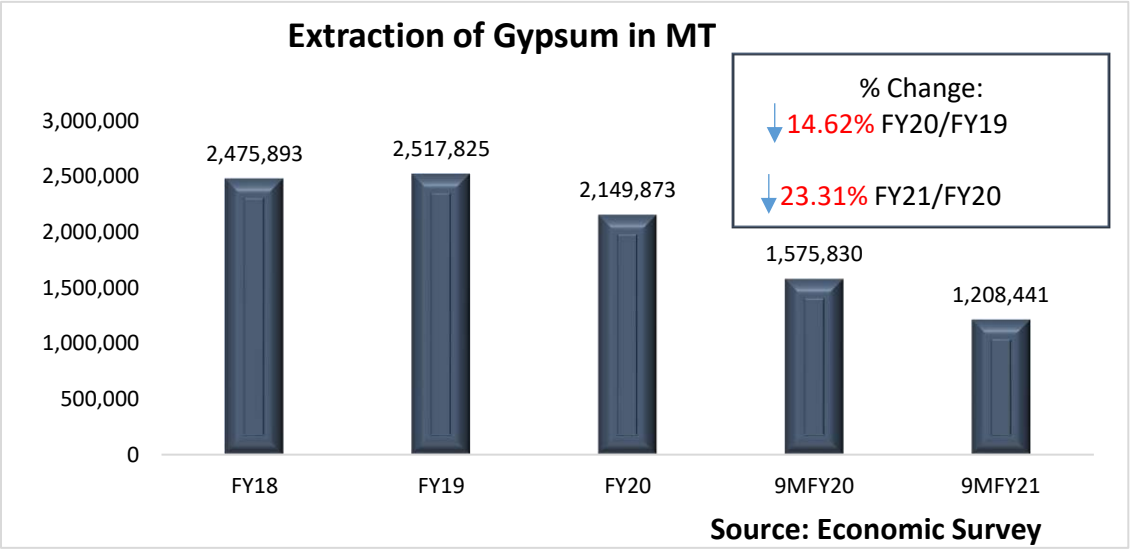
Local Demand of Gypsum

Extraction (Tons)	2,369,829
Imports (Tons)	1,708
Exports (Tons)	5,988
Local Demand (Tons)	2,365,549
	Source: Trade Map, MoF

The extraction can be increased by improving the mining practice in the country and by reducing wastage. The more gypsum extracted the more the processing units will be established and jobs would also be created.

Figure 5

Extraction of Gypsum over 3 years



The extraction of gypsum has been declining from FY19, as seen in Figure 5, as exporters heavily relied on Indian demand because of geographical proximity, and exporters have not shifted their focus from traditional market to new and more versatile markets like Japan, USA and Sri-Lanka (Ministry of Planning, 2018).

International raw gypsum market is estimated to be $ 1.5 Bn, while value added products which are articles of Plaster (sheets, boards and tiles) has a demand of $ 2 Bn globally.

Pakistan's share is less than 0.1% of total world's exports of raw gypsum while value added products exports have been negligible over the years (Comtrade, 2020).

Table 6

Pakistan's Trade and Extraction of Gypsum

HS 252010: Gypsum		
	Unit	Value
Pakistan's Estimated Reserves	Bn Tons	4.8
Extraction (FY20)	MT	2,149,873
Exports Value (2016-2020 Avg.)	$ Mn	10.4
Imports Value (2016-2020 Avg.)	$ Mn	0.29
Avg. Per Unit Export Cost	USD/Unit	46
Avg. Per Unit Import Cost	USD/Unit	50
		Source: *UN Comtrade*

5.6. Processing of Gypsum

Kohat division that comprises of Kohat and Karak districts accounts for 90%, that is, 4.3 Billion tons of KPK's high-quality gypsum. It has 59 mine leases. Currently, there are 158 processing factories including plaster of Paris plants, gypsum powder units, and crush plants (SMEDA, Cluster Development Program, 2017).

Most of the cement factories are located near the prime location of Gypsum reserves in the Kohat region (Ministry of Planning, 2018).

- Kohat Cement Factory at a distance of 30 Km.
- 175 Km from Cherat Cement Factory (Nowshehra).
- 245 Km from Lakki Cement Factory (Pezu, Lakki Marwat).
- 1,100 Km from Cement Factories of Karachi.
- 1,226 Km from Karachi Port.
- 1,615 Km from Gawadar Port.
- 522 Km from Wagah Border Lahore.
- 181 Km from Torkham border.

5.6.1. Gypsum Processing Units in Kohat

Table 7
Gypsum Processing Units in Kohat

Description	Size of the Firm	No. of Units	Production	Price/Unit (Rs.)	Investment (Rs.)
Gypsum Powder Processing	Small Scale	12	34,200 Tons/Year	55/bag (50 Kg or 1,100/Ton)	12 Mn
Gypsum Crush Plants	Medium Scale	15	828,000 Tons/Year	320/Ton	105 Mn
Plaster of Paris Plants	Medium Scale	131*	221,760 Tons/Year	200/bag (50 Kg or 4000/Ton)	1.18 Bn
Total		158	1,083,960 Tons/Year		1.3 Bn
***67 units are closed Source: Planning Commission, Mineral Transformation Plan V2025**					

67 units were closed in Kohat due to crackdown from local authorities on illegal gas connections.

Most of the processing units are operated on coal or wood based heating plants, which are not efficient and production is 3 times less than the one operated on gas.

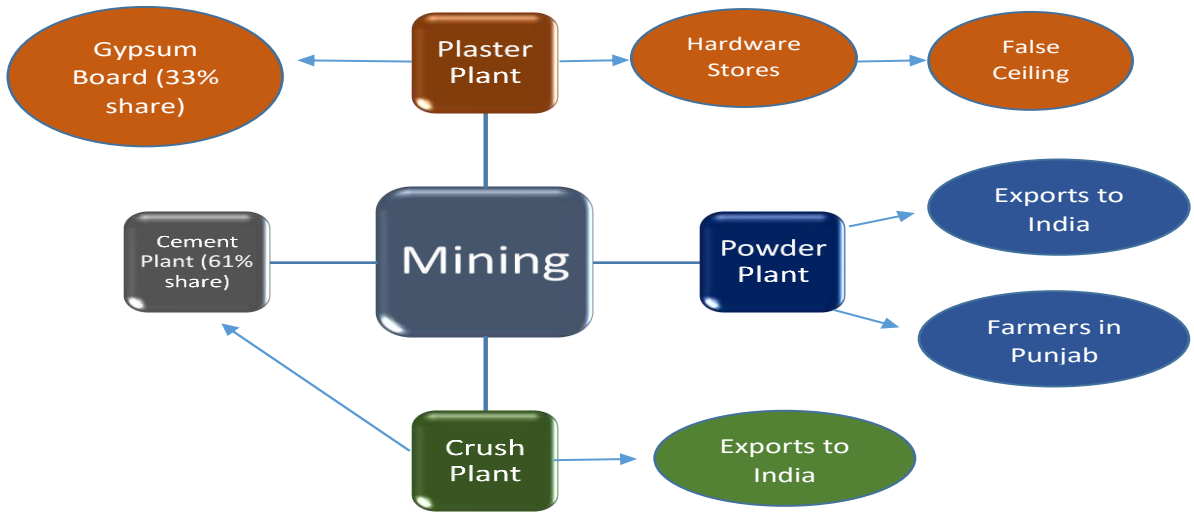
5.7. Supply chain of Gypsum

After mining, mine owners supply Gypsum to three main processing units which include: Plaster Plant, Powder Plant, and Crushing Plant. The powder is used as a fertilizer and mainly depends upon the demand from Punjab and India.

The crush of Gypsum is mainly supplied to cement factories in the country and as per estimates, 61% of Gypsum is utilized by the cement industry as it is used as a hardening retarder in Portland cement. 31% of Gypsum is utilized in the manufacturing of Gypsum Board, and the demand for gypsum board is also expected to be increased by 10% annually. The exports of Gypsum powder and crush currently saw a decline due to trade restrictions but can be capitalized by diversifying to new markets (Ministry of Planning, 2018). This process is demonstrated below.

Figure 6

Supply chain of Gypsum



5.8. Mechanized Mining – need of the hour

In Pakistan, currently mining involves more labor as they are not mechanized and use manual tools as explained above.

According to the planning commission feasibility study 2025 on gypsum, if a single mine starts using an excavator (EX-200), then the production of gypsum will increase from 8,400 tons/year to 120,000 tons/year.

Similarly, if all mine owners in Kohat region, which are 59 in number, start using the excavator then the annual production is projected to be increased 3 times from 2.1Mn tons to 7Mn tons per year.

Table 8

Labor Intensive Mining Vs Mechanized Mining

Existing Situation (Single Mine)	Mechanized Mining
Labor Intensive Mining	Mining with Excavator-EX 200
Production: 04 Labor mine 28 Tons/Day	Production: 400 Tons/Day
Working Days/Year = 300	Working Days/Year = 300
Annual Production/ Year = 8,400 Tons	Annual Production/ Year = 120,000 Tons
Cost of Mining: Rs. 172/Ton	Cost of Mining: Rs. 29.5/Ton
Total Cost : PKR 1.44Mn	Total Cost : PKR 1.44Mn
If all 59 Mines use Excavator	
Annual Production (Tons)	7,080,000
Import Cost from China	$ 5,926/unit or PKR 10 lac/unit @ PKR 170/USD
Tariff rate (%)	0
	Source: SMEDA, TDAP Research

5.9. Sub Surface Gypsum Mining – Example of International Practice

A compact machinery like Vermeer terrain leveler (surface excavation machine) is used in the world like, which is capable of excavating the gypsum rock in small crush shape and eliminating the need of blasting at mine and the need of the primary crushing unit.

Figure 7

Vermeer Terrain Leveler

Source: (Google Images, 2020)

This Machinery can be imported from China at a minimum cost of $ 7,960 with 0% tariff as this HS code (843031) is included in the Free Trade Agreement (CPFTA-II) with China and the distance is also minimum compared with the expensive one available at USA and Sweden.

Table 9

Price and Tariff Comparison of Tunneling Machinery

Product : 843031 Self-propelled coal or rock cutters and tunneling machinery					
	Value in $ Mn (2020)	**Quantity exported**	**Quantity Unit**	**Unit value (USD/unit)**	**Tariff Applied by Pakistan**
World	1,204	-	-	-	-
China	326	40,927	Tons	7,960	0%
USA	169	946	Units	178,812	3%
Sweden	162	5,195	Tons	31,115	3%
Source: Trade Map					

5.10. Value-added products of Gypsum

Plaster of Paris has great industrial importance as it is used in making many value-added products like; filling cracks in walls and gaps, used as fireproofing material, preparing mould, statues and artificial decorative items, used to manufacture tiles, boards, etc., used to make the cast that is used in case of bone fracturing, used in dentistry to fill the gaps in teeth.

Value-added products of Gypsum Plaster can generate foreign exchange earnings for Pakistan if miners, manufacturers, and Pakistani missions overseas are made aware of them in order to improve product marketing.

After increasing the mining activities, the focus must be on setting up processing units. Machinery used in processing of gypsum to Plaster of Paris are; Roller Dryer with Blowers, Grinding Machines, Weighing Machine, Hammer Crusher, Welding Plant, Electric Panel / Change over and Generator 50 KVA[2].

Below are the details of cost of buying above machinery;

[2] Mineral Transformation Plan Vision 2025 Plaster of Paris Plant feasibility study

Table 10

Price Details of Machinery used in Plaster of Paris Plant

Description	Quantity	Total Cost (Rs.)
Roller Dryer with Blowers	1	1,850,000
Grinding Machines	1	1,535,000
Weighing Machine	1	15,000
Hammer Crusher	1	735,000
Welding Plant	1	40,000
Electric Panel / Change over	1	95,000
Generator 50 KVA	1	1,100,000
Safety Switch Board	1	18,000
Total Cost		5,388,000
Source: Ministry of Planning		

SMEDA feasibility report identifies that approximately 5 Kanal land has to be acquired on lease at the rate of PKR 300,000/Kanal (SMEDA, Pre-Feasibility Study of Plaster of Paris Plant, 2021).

Based on the capacity utilization of 70%, sales revenue during the first year of operations is estimated as under.

Table 11

Expected Revenue from Single Plant

Description	No. of Units Produced Kgs	Finished Goods Inventory (Kgs.)	Units available for Sale (Kgs.)	Sale Price/Kg (PKR)	Sales Revenue (PKR)
Plaster of Paris	7,350,000	306,250	7,043,750	8	56,350,000
Total					56,350,000
Source: Ministry of Planning					

5.11. Market of Gypsum

5.11.1. Current Target Market

Currently, 4 products of gypsum are used further in construction industries, cement industries, surgical uses, and as a fertilizer.

Table 12

Current target market of Gypsum

Product	Size	Target Market	Packaging	Price Range (PKR/Ton)
Gypsum Rock	2’	▪ Local Cement Plants ▪Crush Plants ▪ Plaster Factories ▪ Powder Factories	No packing	200 to 360
Gypsum Powder	-	▪Local Plaster of Paris factories ▪Domestic Agriculture farms ▪ Exports to India	Recycled bags: 50 Kg New Bags: 52 Kg	55/bag
Gypsum Crush	-	▪ Cement Plant of Lakki Marwat, Khyber Pakhtunkhwa ▪ Exports to Mini cement plants of India	No packing	320/Ton
Gypsum Plaster	-	▪ Surgical Uses ▪Construction industry	Recycled bags: 50 Kg New Bags: 52 Kg	200/bag
Source: Cluster-Based Mineral Transformation Plan V2025- Feasibility Study				

5.11.2. Potential Niche Markets

Dry prefabricated gypsum products are replacing cement in the global construction industry due to easy installation and are environment-friendly.

With the advent of Gypsum Boards and Tiles to Pakistan’s construction industry, the production of these products started in the country.

Potential niche markets and products are:

▪ **Gypsum Boards**: Housing schemes, and commercial plazas of the country

▪ **Gypsum Tiles:** Housing schemes, and commercial plazas of the country

▪ **High-quality plaster** for dental and orthopedic applications in Pakistan.

5.11.3. Potential Target Customers / Markets

The potential target market for the plaster of paris is general public and corporate customers. In addition to Pakistan's requirements, gypsum plaster can also be exported to Dubai, Saudi Arabia, Afghanistan, and other GCC countries that are facing an unprecedented construction boom.

5.11.4. International Target Market

Pakistan can target the below markets as it has not exported to the USA and Japan as yet. It can also increase its supply to India if the trade relations get better in the future as the current value of exports is negligible. On the other hand, Sri-Lanka is importing around $ 10 Mn of raw gypsum from the world, Pakistan can also tap Sri-Lankan market as both countries have also signed a trade agreement.

Table 13

International Target market of Raw Gypsum

International Target Market				
Japan				
	Value Imported in 2020 ($ Mn)	**Quantity imported in 2020 (Tons)**	**Unit value (USD/Ton)**	**Tariff applied by Japan (%)**
World	86.2	2,391,938		
Thailand	51.0	1,446,655	35	0
Oman	26.6	768,866	35	0
Mexico	6.4	171,763	37	0
Pakistan	0	0	0	0
USA				
	Value Imported in 2020 ($ Mn)	**Quantity imported in 2020 (Tons)**	**Unit value (USD/Ton)**	**Tariff applied by USA (%)**
World	141.1	6,026,491		
Mexico	46.7	2,003,210	23	0
Spain	44.9	1,972,233	23	0
Canada	41.6	1,832,723	23	0
Pakistan	0	0	0	0
India				
	Value Imported in 2020 ($ Mn)	**Quantity imported in 2020 (Tons)**	**Unit value (USD/Ton)**	**Tariff applied by India (%)**
World	89.0	4,951,739		
United Arab Emirates	42.3	2,664,080	16	5

Oman	31.0	1,538,279	20	5
Iran, Islamic Republic of	6.4	456,654	14	5
Pakistan	0	0	0	5
Sri Lanka				
	Value Imported in 2020 ($ Mn)	**Quantity imported in 2020 (Tons)**	**Unit value (USD/Ton)**	**Tariff applied by Sri Lanka (%)**
World	9.06			
Oman	7.22	277,377	26	0
Thailand	1.20	24,418	49	0
UAE	0.9	658	137	0
Pakistan	0.016	220	40	0
Source: ITC Trade Map				

The reason of not targeting the above markets may be lack of awareness of the demand in these countries. Domestic promotion, facilitation of investors to participate in international exhibitions, display centers and export facilitation centers will help in boosting the export of raw gypsum and its value-added products to above target markets.

Chapter 6 Conclusion and Recommendations

Pakistan, being blessed with abundant reserves of Gypsum, has a chance to focus on extracting this mineral as it is cheap and easy to extract, but has a great value and potential to grow locally as well as globally. Pakistani authorities need to give awareness about the product to its miners and manufacturers, additionally, resolving the energy woes so that uninterrupted mining and processing can be done.

6.1. Recommendations

Following recommendations can improve the mining sector of Pakistan;

- Adopting modern techniques in mining to increase productivity as well as reducing wastage and protect the environment.
- Setting-up Processing units near the quarries to reduce cost of transportation.
- Shifting from traditional export pattern to new markets like, Japan, Sri-Lanka and USA.
- Awareness to manufacturers and exporters of green products and their demand in international market.
- Revamping of closed processing units in Kohat and providing basic utilities like gas and electricity.
- Manufacturing of more-value added products like gypsum ceiling tiles, boards can increase the exports of Pakistan and it will become part of $ 2 Bn export market.
- A separate mining zone can also be established to have a complete value-chain at one place which will then make the product more competitive in the international market.
- Removing infrastructure bottlenecks, establishing a centre of excellence for developing quality manpower and forging partnerships with global operators and technology providers also need a prominent place in the “to do” list.

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