Business Opportunities in Mineral Sector of Pakistan: A Case Study of Fluorite

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Business Opportunities in mineral Sector of Pakistan: A Case study of Fluorite

A joint research study of Trade Development Authority of Pakistan and Employers Federation of Pakistan.

Authorized By

Dr. Khalid Mustafa, Research Head TDAP

Authored By

Suleman Akram, Research Associate TDAP

Yusra Sadiq, Research and Development Officer LCCI

Uzair Shoro, Research and Development Officer LCCI

Areeba Irfan, Research and Development Officer LCCI

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For any queries or feedback regarding this publication, please contact at

Suleman.akram@tdap.gov.pk

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LIST OF ABBREVIATIONS

B	Bn	Billion
F	FY	Fiscal Year
H	HS Codes	Harmonized System Codes
K	KPK	Khyber Pakhtun Khwa
L	LCCI	Lasbela Chamber of Commerce and Industry
M	MM	Millimeter
	MT	Metric Tons
P	PBR	Pakistan Bureau of Statistics
	PES	Pakistan Economic Survey
	PKR	Pakistani Rupee
	PSIC	Pakistan Standard Industrial Classification
U	USD	United States Dollar
T	TDAP	Trade Development Authority of Pakistan
	TPD	Tons Per Day

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Pakistan has little to no minerals beneficiating industries which has made the country one of the top exporters of raw material ore and importer of valuable chemical products leading to a huge economic crunch.

EXECUTIVE SUMMARY

There are significant mineral deposits in Pakistan. Pakistan only commercially exploits 52 of the 92 minerals found. Pakistan exports raw minerals or minerals with minimal value additions. For this reason, TDAP and LCCI signed a memorandum of understanding to do research on how to make minerals so efficient that they create a substantial amount of foreign exchange for Pakistan.

Fluorite deposits are widely distributed across Baluchistan and KPK, particularly in the districts of Loralai and Parachinar. Mining companies are unable to install their mineral washing plants close to their mines due to infrastructure and law and order issues, which raises transportation costs. Similarly, due to financial difficulties, companies are unable to invest in high-tech fluorite purification plants, which can increase purity levels above 95%. While the cost of acid grade fluorite on the global market is 600 USD per ton, Pakistan exports upto 80% pure fluorite for 400 USD per ton.

Thus, in this study, TDAP conducted the market-based research (i.e., potential markets, value chain analysis, tariff analysis), and LCCI provided the financial feasibility, so that various investors may be attracted to this business and, before making an investment decision, this study will guide them about machinery, their price, different costs associated with labour, transportation, etc.

Investors therefore have the chance to invest in a facility that can purify raw fluorite to a 95% plus pure grade. Fluorite that is 95 percent pure is widely employed in a variety of fields, including the chemical, medicinal, mechanical, and imaging sectors. This commodity is often demanded for 550–600 USD a ton by various importers from around the world.

This research is divided into six chapters: the first deals with introduction, the second with market overview, the third with value chain analysis, the fourth with financial feasibility, the fifth with challenges in the fluorite sector, and the final with conclusion and recommendations.

CHAPTER 1

INTRODUCTION

Pakistan is rich in mineral resources mainly Baluchistan and KPK are rich in natural resources. As per Pakistan Standard Industrial Classification (PSIC) 2010, the sector includes the extraction of minerals occurring naturally as solids, liquids or gases. Apart from this, sector also includes services incidental to mining e.g., drilling services, derrick erection accompanied with other supplementary activities such as crushing, grinding, cleaning, drying, sorting, concentrating ores to prepare crude materials. The sector posted a negative growth of 4.5 percent during FY2022 against the positive growth of 1.2 percent last year. Owing to its unique geological condition, Pakistan is blessed with huge deposits of several minerals such as coal, copper, gold, chromite, mineral salt, bauxite, and several others. Despite of the huge potential, sector is lagging due to lack of infrastructure, poor technology and limited financial support. During July-March FY2022, production of major minerals such as Coal, Natural Gas, Chromite, Crude Oil and Barytes witnessed the growth of 8.34, 3.45, 25.7, 4.48 and 162.5 percent, respectively (PES, 2021-22). Out of 92 known minerals 52 are commercially exploited in Pakistan (PES, 2019-20).

In Pakistan different minerals are exported in raw form while Pakistan can earn huge foreign exchange by doing only little value addition for example China has been importing significant amounts of raw material and by transferring it into finished products increasing exports (Pui-Kwan Tse 2013). Same Pakistan can also get benefits from this sector. Mineral sector has low portion in the GDP of Pakistan which can be further increase and more employment can be generated. Mining and quarrying have only less than 3% of share in the Pakistan economy. While China's Mineral Trade accounted for about 25% of the country's total trade. So this sector has huge potential of growth.

In this study the main focus of mineral is fluorite. The primary uses of fluorite are flux in steel manufacture, opalescent glass, enamels for cooking utensils, hydrofluoric acid, high-performance telescopes, camera lens etc. This mineral is also used as gem stone. According to trademap in 2022 Pakistan exported gem stones worth of USD 5.08 million while Pakistan exported fluorite worth of USD 19.2 million.

1.1 Reserves of Fluorite in Pakistan

Balochistan has estimated deposits of 50000 tonnes, and this material is also exploited in KPK. According to a Pakistani economic survey, the country's total fluorite reserves are 100000 tonnes.[1]. Due to lack of infrastructure and survey the latest overall reserves are not identified.

Dilband: The first largest deposit of fluorite (over 0.1million ton) is in Dilband and in its vicinity in Kirthar foldbelt.

Mula-Zahri: The second largest deposit of 6750 tons of green fluorite is in Mula-Zahri Range of Kirthar foldbelt.

Loralai: The third largest deposit of fluorite is found in Loralai district and its vicinity in Sulaiman foldbelt. The fluorite of Loralai area occurs as veins and as disseminated grains along faults and fractures which is hosted by the Jurassic Loralai limestone forming the anticlinal core. 50000 deposits of fluorite are estimated in Loralai district.

Attractive gem quality fluorite crystals are found in light-green, yellow and light-blue colors from Mekhtar, Wategam Zarah of Loralai district.

KPK: in kpk fluorite reserves are present in Mirgasht Gol, Yarkhun valley, Chakdara, Bicheha Kurd[2] but quantity of reserves is not available.

1.2 Significance of the Study

The total global export market for fluorite is USD 553 million; however, gemstone quality fluorite is not included in this figure. Fluorite is abundant in Pakistan and can be used to produce foreign cash. The price of raw fluorite ranges from $200 USD to 550 USD per tonne. As a result, this study will provide business options that will benefit both the country and the investors.

1.3 Objectives of Research

The primary goal of this research is to determine how to improve the export of value-added fluorite products so that Pakistan may earn more foreign exchange, while simultaneously increasing employment and economic activity through value addition.

1) Identification of challenges and investment potential in Pakistan's fluorite industry.
2) How to increase the value-addition of fluorite?

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[1] https://www.finance.gov.pk/survey/chapters_17/03-Manufacturing.pdf
[2] http://nceg.uop.edu.pk/GeologicalBulletin/Vol-Special-2013/Abstract21.pdf

CHAPTER 2

MARKET OVERVIEW

2.1. Fluorite Industry of Pakistan

Calcium and fluorine make up the significant commercial mineral known as fluorite (CaF2). In numerous chemical, metallurgical, and ceramic processes, it is employed. Exemplary diaphaneity and color specimens are cut into gems or utilized to create beautiful items. Hydrothermal processes lead to the deposition of fluorite in veins. It frequently appears as a gangue mineral mixed together with metallic ores in these rocks. Additionally, fluorite can be found in some dolomites and limestone's' cavities and cracks. It is a very typical rock-forming material that may be found all over the world. Fluorite is frequently referred to as "fluorspar" in the mining industry.

2.2 Fluorite reserves in the world:

2.2.1 Total reserves in the world

Mexico has the highest reserves in the world that are 68 million tons. While on the second number China has 42 million reserves[3]. Reserves of all other countries are shown in figure 1.

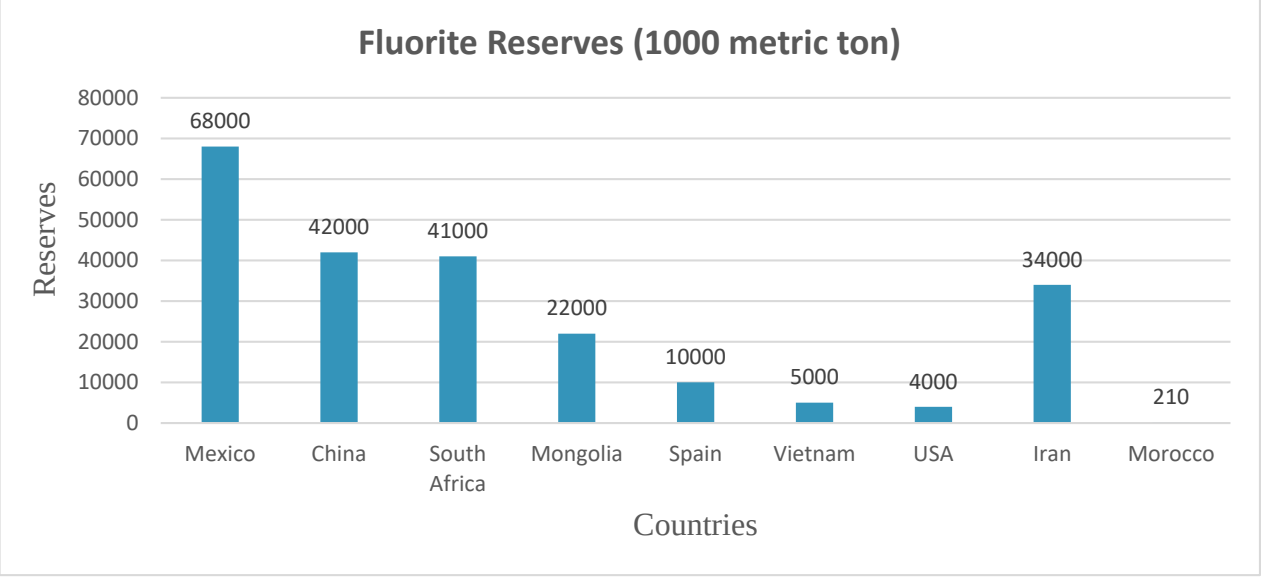

Figure 1: Fluorite Reserves Worldwide

[3] https://www.statista.com/statistics/270406/distribution-of-fluorspar-reserves-worldwide-by-country/

2.3 Fluorite Production:

China is the top country in the world that produces fluorite by importing ore. Mexico and Mongolia are the top two producers, and Pakistan is ranked 11th in the production of fluorite.[4]

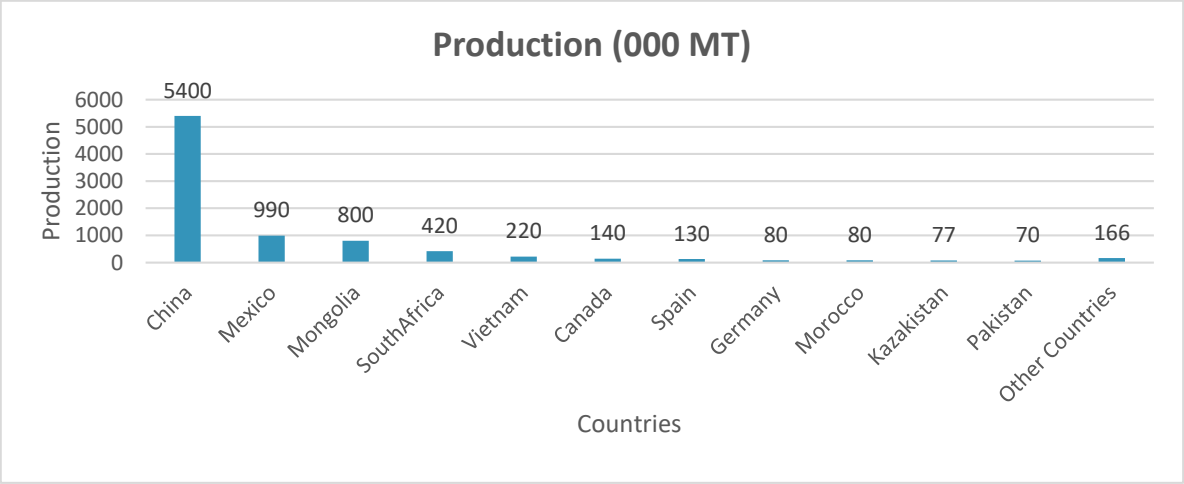

Figure 2: Global Fluorite Production

Fluorite is mined in Pakistan using both open pit and tunnel mining methods. The mining industry is quite modest. The mining quantity is quite small. The color of fluorite ranges from colorless and completely transparent to dark colors i.e. yellow, green, blue, purple, pink and black. Purple and green are the most popular colors.

Production data of fluorite is not available after 2014 and figure no 3, Shows the annual production of fluorite from 2005-2014

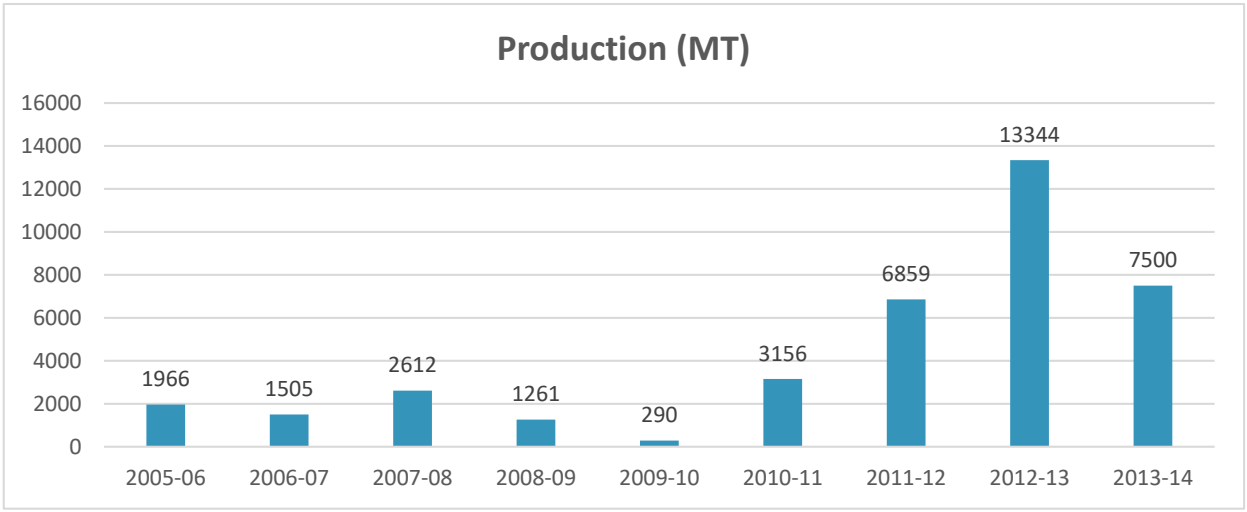

Figure 3: yearly production of Fluorite (2005-2014)

[4] https://www.statista.com/statistics/1051717/global-fluorspar-production-by-country/

Source: Pakistan Bureau of statistics

While in 2020 production of fluorite was 70000 metric ton.[5] In pakistan accurate yearly data of fluorite is not available.

2.4 World Trade Market Overview:

Fluorite's entire global market in 2021 was 787.8 million dollars. In 2020-2021, Pakistan exported 67228 metric tonnes of fluorite and earned a total of 3177 million rupees. While Pakistan spent 155.62 million rupees to buy only 5151 metric tonnes of fluorite (Source, PBS).

2.4.1 Top Importers and Exporters of Fluorite of HS-Code 252921:

Table 1: World Trade of Fluorite under HS-Code 252921

Importers of Fluorite (HS-Code 252921)			Exporters of Fluorite (HS-Code 252921)		
Country	Imported Value	Share of Import (%)	Country	Export Value	Share of Export (%)
China	77.889	22.4	Mongolia	126.826	39.2
Russian	37.714	10.9	China	67.154	20.8
Indonesia	36.077	10.4	S. Africa	21.177	6.5
R. Korea	18.955	5.5	Mexico	19.236	5.9
Türkiye	15.876	4.6	Pakistan	19.17	5.9
Japan	13.519	3.9	Netherlands	12.109	3.7
India	11.408	3.3	Morocco	10.935	3.4
Italy	10.73	3.1	Germany	9.005	2.8
USA	8.943	2.6	Italy	8.1	2.5
Ukraine	8.486	2.4	Kazakhstan	6.833	2.1

Source: Trademap

In 2021 China, Russia, and Indonesia were the world's top importers of fluorite with purity less than 97%. These three countries imported over 44% of the world's total. Mongolia and China were the

[5] https://www.statista.com/statistics/1051717/global-fluorspar-production-by-country/

main exporters. In importing countries, this grade of fluorite is used in steel manufacture and ceramics industry.

2.4.2 Top Importers and Exporters of Fluorite of HS-Code 252922:

Table 2: World Trade of Fluorite under HS-Code 252922

Importers of Fluorite (HS-Code 252922)				Exporters of Fluorite (HS-Code 252922)		
Country	**Imported Value**	**Share of Import (%)**		**Country**	**Exported value**	**Share of export (%)**
USA	109.883	25		Mexico	72.398	31.5
India	86.763	19.7		Viet Nam	50.666	22
Italy	60.954	13.8		S. Africa	28.054	12.2
Germany	58.473	13.3		China	20.431	8.9
China	32.489	7.4		Mongolia	17.256	7.5
Japan	21.845	5		Germany	10.423	4.5
Tunisia	14.682	3.3		U K	6.494	2.8
R. Korea	11.845	2.7		USA	4.911	2.1
Canada	9.725	2.2		Morocco	4.707	2
Belgium	5.531	1.3		Netherlands	4.108	1.8
Source: Trademap						

In 2021, the top four countries importing fluorite with a purity of over 97% were the United States, India, Italy, and Germany. From various nations around the world, these three nations import more than 71% of all exports. This form of fluorite is utilized in the production of acids and in the gem and jewelry industries. Mexico, Vietnam, and South Africa are the major exporters of 97% purity grade fluorite.

2.5 Pakistan's fluorite import and Exports Trends:

In Pakistan fluorite mainly extracted from Lorlai district of Baluchistan. In this below graph total import and export of less than 97% of fluorite and greater than 97% of fluorite is shown.

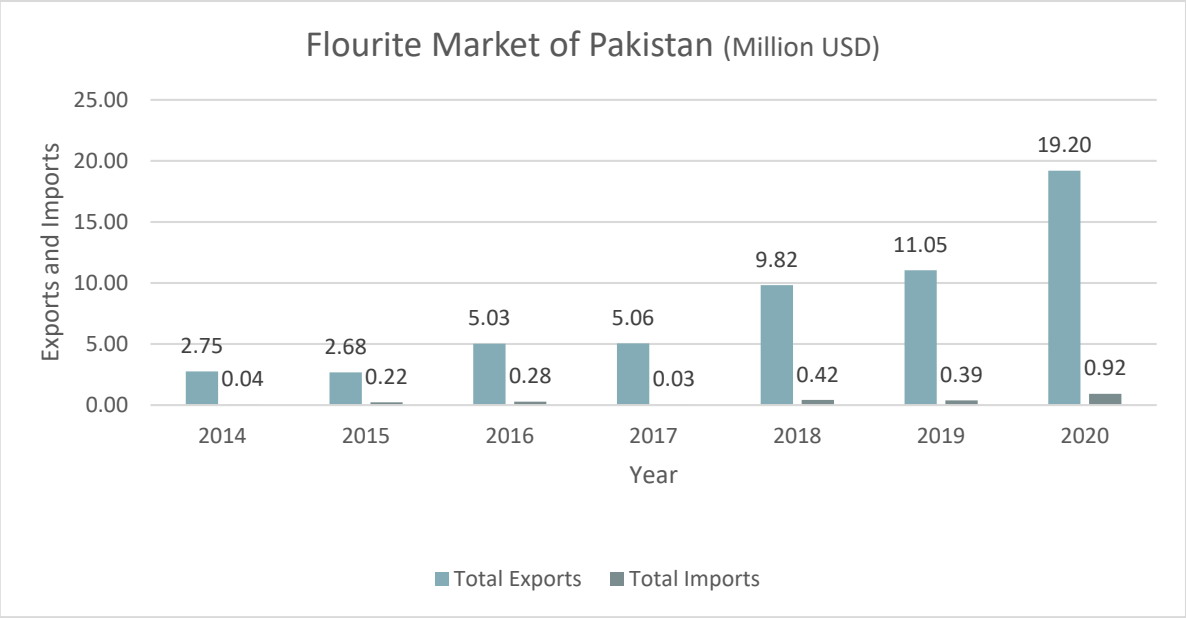

Figure 4: Yearly trade statistics of Fluorite

2.6 Potential Markets, Price, and Tariff Analysis

This section will examine the prices and tariffs of various nations to see which could serve as viable export markets for Pakistan.

According to Northwest Mineral trade Co., a miner and exporter from Pakistan, fluorite exists in Pakistan at grades 60–90, with an export price ranging from $200–$300 per tonne. While the price per ton to buy it from miners is 15,000 to 20,000 Pakistani Rupees.

2.6.1 Existing Export Destinations of Pakistan.

The Trademap database shows that Pakistan faces zero percent in tariffs on exports of fluorite to Turkey, the Republic of Korea, Italy, Saudi Arabia, Thailand, and Malaysia.

Table 3: Existing Export Destinations of Pakistan

Export Destinations	Price Per Ton	Tariff
Turkeye	339	0
Republic of Korea	260	2
Italy	364	0
Saudi Arabia	198	5
Thailand	297	0
Malaysia	269	0
Source: Trademap		

In the table # 3prices and tariffs are shown only Saudi Arabia and Republic of Korea has applied 5% and 2% tariff on import from Pakistan. According to unit price analysis.

Table 4: Potential Fluorite Markets for Pakistan

Potential Markets	Average Import Price from World	Tariff on Pakistan (%)	Potential Markets	Average Import Price from World	Tariff on Pakistan (%)
Indonesia	511	0	Germany	553	0
Japan	540	0	UAE	309	5
Italy	541	0	Netherlands	567	0
Source: Trademap					

In above Table Indonesia, Japan, Italy, Germany, UAE and Netherlands are the potential markets for Pakistan, where Pakistan can export at higher rates.

CHAPTER 3

VALUE CHAIN ANALYSIS

3.1 Uses of Fluorite:

Fluorite has a wide variety of uses. The primary uses are in the metallurgical, ceramics, and chemical industries; however, optical, lapidary, and other uses are also important[6].

Metallurgical Industry

Fluorite uses in the metal, glass and enamel industry to lower the melting temperature to save the energy[7]For every tonne of metal made, 20-60 pounds of fluorspar are used. It is utilised as a metal refining agent while also playing a role in lowering the sulphur content of steel.8

Chemical and medical Industry

Fluorite is utilised in the synthesis of numerous pharmaceuticals and industrial chemicals, including hydrofluoric acid, aluminium fluorites, fluorocarbons, fluoropolymers like Teflon, fluorodeoxyglucose, and the antibiotic ofloxacin, among many others.[9]

Ceramic Industry:

Ceramics, enamelware, and specialty glass are all made with fluorite. In order to create hard glossy surfaces, opalescent surfaces, and a variety of other looks that make consumer glass goods more appealing or more durable, fluorspar is used to generate glazes and surface treatments. Teflon, a non-stick cooking surface, is manufactured with fluorine that comes from fluorite.

Gem and Jewelry industry

High grade fluorite is used in the ornament and jewelry. Which can be sell relatively at higher prices.

Other Usage

Optical Usage and Lapidary Usage.

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[6] https://geology.com/minerals/fluorite.shtml
[7] https://www.greenfacts.org/en/fluorite/fluorites-2/01-use.htm#:~:text=It%20is%20used%20in%20the,(for%20glues%20and%20wood).
[8] https://www.eurofluor.org/hf-applications/metallurgical-industry/
[9] https://www.healthline.com/health/what-is-fluorite#benefits

3.2 Value Addition:

Pakistan lacks efficient and high-tech machinery for producing fluorite-based value-added products. In the value addition section, the purity of fluorite was enhanced by eliminating related minerals from it. Pakistan only exports fluorite concentrates and fines to Turkey, the Republic of Korea, Italy, Saudi Arabia, Thailand, and Malaysia..

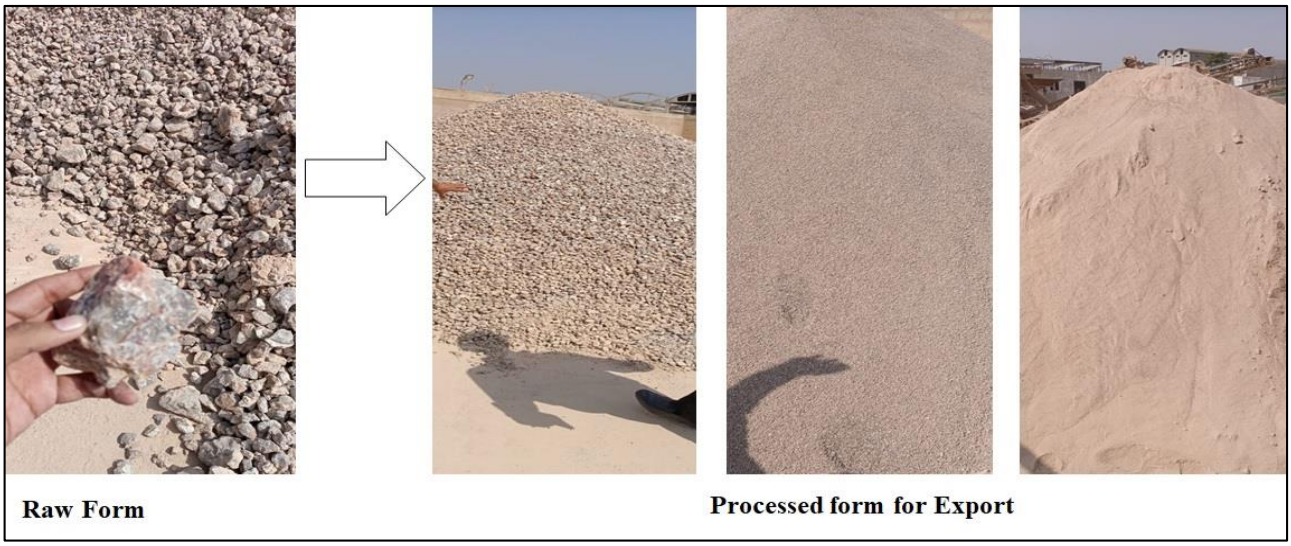

Figure 5: Value-addition process of Fluorite

Source: TDAP Research Wing

In Pakistan, the value addition process only includes washing, drying, and the production of fines and concentrates. Pakistan produces calcium fluorite fine powder up to 30mm in size. Figure 4 depicts the source materials and end fluorite outputs.

3.3 Mining of Fluorite:

Fluorite is mined in Pakistan using both open pit and underground methods. Excavators are used by various firms in open pit mining to extract fluorite lumps and sand. In underground mining LT machines or dynamite blasting are used to reach the mine, in the next process manual hammering and loading on trucks are included.

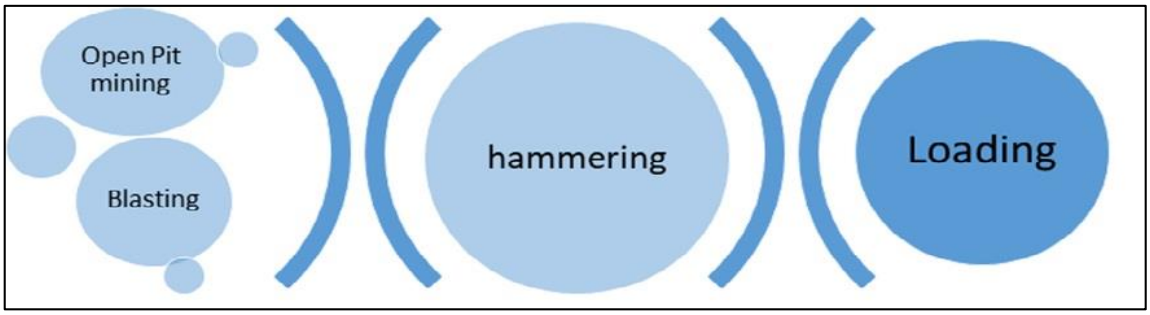

Figure 6: Mining steps in Pakistan

Source: TDAP Research Wing

3.4 Processing stages of Fluorite in Pakistan.

Pakistan can export up to 90 grade fluorite. This grade can be obtained by hand hammering, crushing, and washing on the plant. In the first step, lumps of fluorite are crushed into small pieces by a jaw crusher, and then a separator machine separates different millimeter sizes of fluorite stone. Sand is then processed through a spiral machine and a shaking table, 1-10 mm stones are processed by a jig machine, and stones larger than 10mm are handpicked. Figure 2 depicts this procedure graphically.

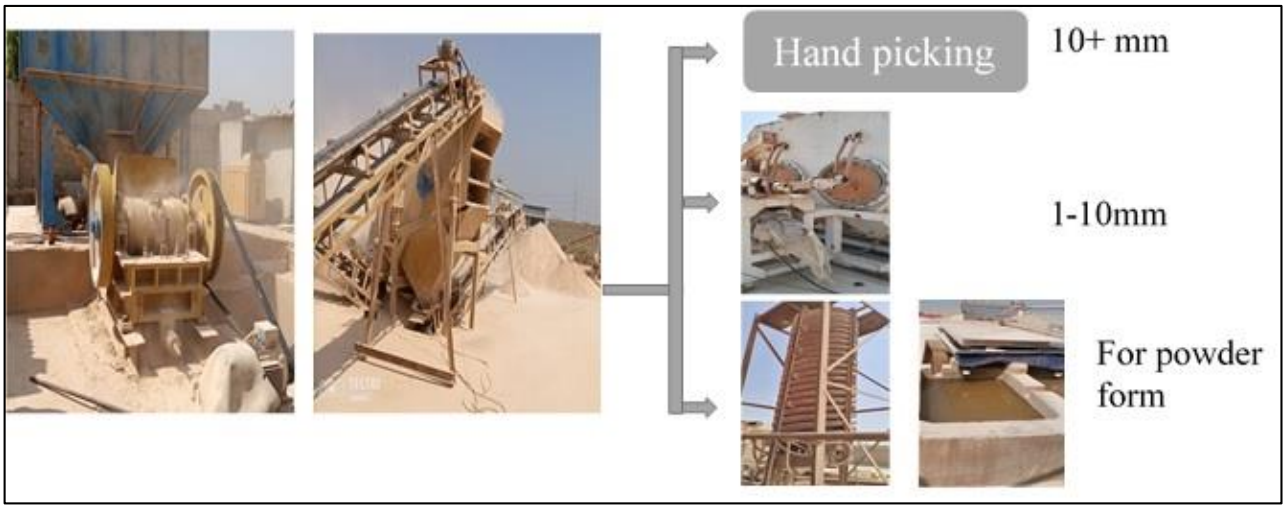

Figure 7: Processing line of Fluorite

Source: TDAP Research Wing

3.5 Cost Analysis

The overall cost of mining from Lorelai to final selling price is shown in the table below. In this area, landowners do not lease mines to companies; instead, they mine themselves, loading the raw fluorite into small trucks and transporting it to their warehouse, where they remove impurities. The

total cost of this technique is PKR. 26000 per ton. While the cost of transportation from Loralai to Karachi is PKR. 6000-7000 per ton. And the average selling price of 70 Grade is 300 dollars and for 80 Grade is 350 dollars.

Table 5: Cost and profit margins of Fluorite

Mining + Transportation + Taxes	RS. 45000/ton
Processing cost	RS. 12000/ton
Initial investment on washing Plant	RS. 0.6-25 Million
Selling price	
70 Grade	USD 300 (PKR. 67000)
80 Grade	USD 350 (PKR. 78750)
Profit	
Profit Margin	15-20% (14000-17500/per ton)
Source: TDAP Research Wing	

In this sector profit margin by exporting fluorite is 15-20% which is highly attractive. If different investors invest more in this sector to obtain 95 plus grade of fluorite the Pakistan can earn USD 600 per ton which is more beneficial for Pakistan and business. In the below table total cost of fluorite processing plant and profit margins are mentioned.

CHAPTER 4

FEASIBILITY STUDY

The viability of basic washing plants and higher processing plants will be explored in this section. Advanced processing plants are used to produce acid grade fluorite, which is 95% pure fluorite, whereas basic washing plants can only raise the purity of fluorite to 85-90%.

4.1 Small scale Washing Plant Installation Cost:

According to Northwest minerals trading company a simple beneficiation plant that do only crushing and separate impurities of fluorite cost around PKR 25 million while other plants can cost 4 million rupees in which labor have major share.

Table 6: Cost of Fluorite Processing Plant.

Feasibility of Washing plant (Fix capital)	
Jaw Crusher	750,000
Spiral machine	250,000
Conveyor	200,000
Generator	2,500,000
Shaking Table	700,000
Washing Plant	3,000,000
Civil Work	17,622,832
Total Cost	25,022,832

Source: TDAP Research Wing.

4.2 Feasibility of High-tech fluorite beneficiation Plant

The raw fluorite ore price is around 55 USD per ton with a purity of around 40%. By converting this to its value-added product, we can generate huge revenue as the final product, i.e., 97% CaF_2 can be sold for up to 550 USD per ton.

From the feasibility analysis of 100 TPD Fluorite beneficiation plant, the estimated net income per year is shown below. The payback period is estimated as two years, eight months and the Internal rate of return is 29% for the period of five years.

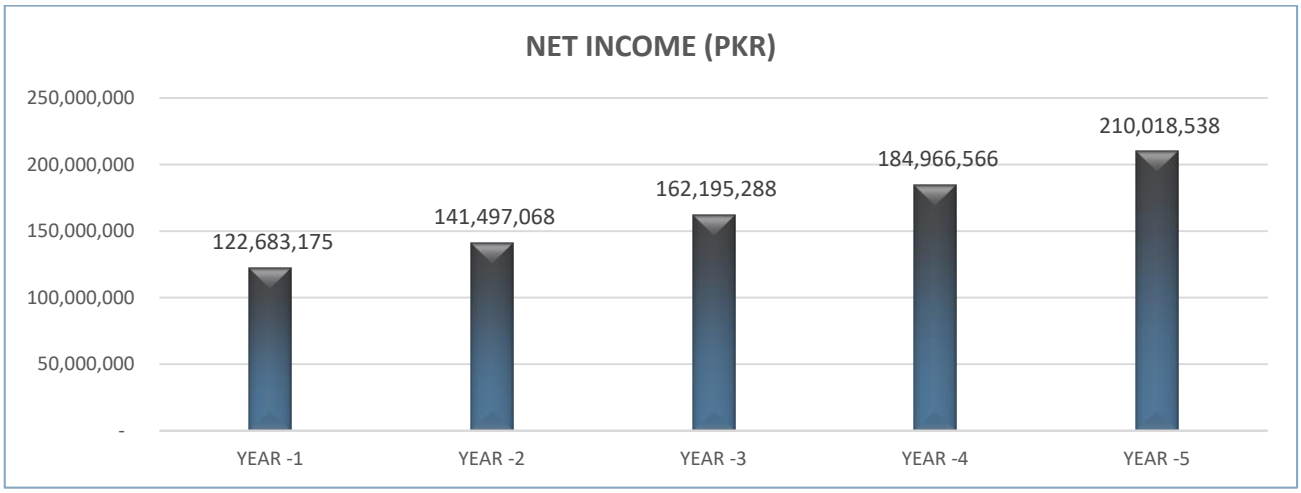

Figure 8: Net income of 5 Years

Source: Lasbela Chamber of Commerce and Industry research wing

4.2.1 Five-year projections:

Below are the five-year financial projections of fluorspar beneficiation plant:

Table 7: Financial projections for 5 years

	MONTHLY	YEAR -1	YEAR -2	YEAR -3	YEAR -4	YEAR -5
	AMOUNT (PKR)	AMOUNT (PKR)	AMOUNT (PKR)	AMOUNT (PKR)	AMOUNT (PKR)	AMOUNT (PKR)
REVENUES						
97% CaF2	111,375,000	1,336,500,000	1,470,150,000	1,617,165,000	1,778,881,500	1,956,769,650
DIRECT COSTS						
Electricity	21,456,000	257,472,000	283,219,200	311,541,120	342,695,232	376,964,755
Gas	4,593,186	55,118,232	60,630,055	66,693,061	73,362,367	80,698,603
Water	1,585,020	19,020,240	20,922,264	23,014,490	25,315,939	27,847,533
Raw Material	36,000,000	432,000,000	475,200,000	522,720,000	574,992,000	632,491,200
Freight	5,100,000	61,200,000	67,320,000	74,052,000	81,457,200	89,602,920
Reagents	1,346,769	16,161,228	17,777,351	19,555,086	21,510,594	23,661,654
Salary	1,755,000	21,060,000	23,166,000	25,482,600	28,030,860	30,833,946
Packaging Cost	1,350,000	16,200,000	17,820,000	19,602,000	21,562,200	23,718,420
Repair & Maint.	3,939,653	47,275,837	52,003,421	57,203,763	62,924,139	69,216,553
Miscellaneous	100,000	1,200,000	1,320,000	1,452,000	1,597,200	1,756,920
INDIRECT COSTS						
Depreciation	3,231,320	38,775,837	38,775,837	38,775,837	38,775,837	38,775,837
Shipping Cost	13,500,000	162,000,000	178,200,000	196,020,000	215,622,000	237,184,200
Interest Expense	6,697,410	33,754,948	31,657,203	29,345,489	26,797,981	23,990,626
TOTAL COST	100,654,358	1,161,238,321	1,268,011,330	1,385,457,446	1,514,643,549	1,656,743,167
PBT	10,720,642	175,261,679	202,138,669	231,707,554	264,237,951	300,026,483
Income Tax	3,216,193	52,578,504	60,641,601	69,512,266	79,271,385	90,007,945
PAT	7,504,449	122,683,175	141,497,068	162,195,288	184,966,566	210,018,538
CASHFLOWS						
Depriciation	3,231,320	38,775,837	38,775,837	38,775,837	38,775,837	38,775,837
OPERATING CASHFLOW	10,735,769	161,459,012	180,272,905	200,971,125	223,742,403	248,794,375

Source: Lasbela Chamber of Commerce and Industry research wing

4.2.2 Assumptions

The feasibility study was constructed taking the following assumptions into account. All these values are subjected to change according to the new policies introduced by the Ministry of Commerce and State Bank of Pakistan.

Table 8: **General Assumptions taken into Account.**

DESCRIPTION	UNIT	BASE	SOURCE
Macro Assumptions			
Exchange Rate Projection		226.21	
Domestic Inflation	%	10	State Bank of Pakistan
KIBOR	%	14	State Bank of Pakistan
Interest rate on long term loan form bank	%	10.2	State Bank of Pakistan
General Assumptions			
Income Tax	%	30%	
Other duties and taxes	%	4%	
Equipment useful life	Years	10	
Building useful life	Years	10	
Debt Ratio	%	70%	
Revenue			
CAGR	%	4	
Selling price projections per year	%	10	
Depreciation Rates			
Land	%	0	
Building	%	10.00%	
Plant Machinery	%	10.00%	
Vehicles	%	10.00%	
Equipment	%	10.00%	

CHAPTER 5

Issues

There are number of issue that investors and this sector face some are as following

1. Lack of infrastructure at the mining site, which increases transportation costs. For instance, miners extract minerals from mines and then carry those resources by tiny trucks to the surface.
2. Due to the law and order situation, investors do not install washing operations near mines. Hence two types of costs must be borne in this sector. The first is transportation because all pollutants cannot be removed, so the weight of impurities is also included in transportation cost. The second expense is labour, which is incurred when miners carry fluorite on the ground and physically remove contaminants in the first step.
3. Investors do not have awareness about the fluorite mineral's importance, usage, and possible profit margins.

Chapter 6

Conclusion/Recommendations

In Pakistan there are vast reserves of fluorite. In Pakistan little value addition is happen on very small scale level due to lack of investment and infrastructure in this sector. While different investors don't know the attractiveness of fluorite value addition by investing only PKR 100 million a massive return can be attain i.e 20% profit. So the following recommendation are suggested.

1. Conduct seminars for awareness to investors.
2. Government should implement ban on export Fluorite that would be less than 90% pure.
3. Concessionary loans should be given to investors for machinery import.
4. One time exemption should be given for import of machinery.